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ABSTRACT

This study used a new specification of participation in vocational education to estimate the effects of high school curriculum on the labor market experiences of youth. Five patterns of participation developed in an earlier study--intensity of training, continuity of training, proximity of training to time of graduation, diversity of program areas, and the addition of logically related study outside the main area of specialization--were identified and labeled Concentrator, Limited Concentrator, Concentrator/Explorer, Explorer, and Incidental/Personal according to degree of involvement in vocational education. Estimates were derived for effects on earnings, training-related placement, labor force status, job prestige, and other job characteristics using data from the National Longitudinal Survey of Labor Market Experience (NLS), New Youth Cohort, supplemented with high school transcripts of survey participants. It was found that increasing concentration in vocational education (the three concentrator patterns) increased likelihood of holding a conventional job (as classified by Holland). It was also found that Incidental/Personal and Concentrator/Explorer participants were much less likely than Concentrators or Limited Concentrators to be in training-related employment; and that Women Concentrators earned more per week than respondents who took no vocational courses. The study concluded that vocational education policy should be concerned with inducing pride in work, with looking at long-term training needs, with emphasizing helping disadvantaged groups, and with working within the prevailing economic conditions. (KC)

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EMPLOYMENT EXPERIENCES OF STUDENTS WITH VARYING PARTICIPATION IN SECONDARY VOCATIONAL EDUCATION

A Report Based on Transcript and Interview Data of the 1979 and 1980 National Longitudinal Survey New Youth Cohort

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FOREWORD

The labor market impact of the high school vocational curriculum has been studied using self-report, administrative designation, or number of credits as indicators of the vocational education experience. The variability of secondary vocational education has not, however, been adequately reflected by indicators of this type. This second report, building upon the five patterns of participation developed in the first paper of this series of three, examines labor market experience in a way that takes into account the variability of participation in secondary vocational education.

The major focus of the report is on the relationships between patterns of participation and labor market experience. Relatedness of jobs to training, labor force status, hourly rate of pay, and prestige of jobs are labor market factors that are examined. The combined data from the National Longitudinal Survey (NLS) of Labor Market Experience, New Youth Cohort (NLS Youth), and the high school transcripts of a subsample of the NLS panel were used for analysis. The transcript data permitted the use of more precise and descriptive curriculum classification measures for the high school graduates for whom the comparisons were made.

The National Center is appreciative of the U.S. Department of Labor's research effort, the New Youth Cohort of the National Longitudinal Survey. Additionally, the National Center extends its appreciation to the U.S. Department of Education, Office of Vocational and Adult Education, which funded the National Center to collect the transcript data and to conduct extensive analysis of the effects of participation in vocational education.

Dr. Michael Borus, Director of the Center for Human Resource Research, The Ohio State University, was most cooperative in entering into the agreement under which the transcript data were merged with the interview data of the New Youth Cohort and from which this report was prepared. We wish to express our appreciation to Dr. Borus and to two of his staff members, Susan Carpenter and Michael Motto, who assisted in conducting the analysis for this report.

This project was conducted in the Evaluation and Policy Division of the National Center under the direction of N. L. McCaslin, Associate Director. We wish to thank the project staff, Paul B. Campbell, Fidelia Chukwuma, Sterling Cox, John Gardner, Morgan V. Lewis, Mollie Orth, and Patricia Seitz for their work in preparing this report. Annegret Harnischfeger of Northwestern University, Edmond Marks of Penn State University, and Larry Hotchkiss of the National Center enhanced the quality

of the report through their thoughtful critiques and suggestions. Final edit of the report was provided by Brenda Sessley of the National Center editorial staff. Bernice DeHart, Kathleen Medley and Terri Martin prepared the document with meticulous care.

Robert E. Taylor
Executive Director
National Center for Research
In Vocational Education

EXECUTIVE SUMMARY

This study used a new specification of participation in vocational education to estimate the effects of high school curriculum on the labor market experiences of youth. The new specification was developed in an earlier paper as part of this same project, and it involved identifying five patterns of vocational education participation. The patterns of participation were developed by operationalizing five descriptive concepts that reflect the variability of vocational participation. The concepts included intensity of training, continuity of training, proximity of training to time of graduation, diversity of program areas in which training was received, and the addition of logically related study outside the main area of specialization. Cases were assigned to a pattern group based on the scores obtained from transcripts for these concepts. The five pattern groups were labeled Concentrator, Limited Concentrator, Concentrator/Explorer, Explorer, and Incidental/Personal and were ordered by the degree of involvement in vocational education.

Estimates were derived in the present paper for effects on earnings, training-related placement, labor force status, job prestige, and other job characteristics. The effects were estimated using data from the National Longitudinal Survey of Labor Market Experience (NLS), New Youth Cohort. These data were collected by the Center for Human Resource Research, The Ohio State University, funded by the U.S. Department of Labor. They were supplemented with transcripts collected for the National Center for Research in Vocational Education through a contract with the U.S. Department of Education, Office of Vocational and Adult Education. The sample consists of high school graduates for whom complete high school transcripts for grades nine through twelve were available. Comparisons with another national sample show it to be representative of high school youth.

Estimates were derived using three techniques. Job characteristics by patterns of participation in vocational education were analyzed using several bivariate cross-tabulations. Training-related placement and labor force status were examined using log-linear analyses of multiway tables. Estimates of effects on earnings were obtained using ordinary least squares regression.

Job characteristics examined were those associated with Holland's classification of jobs. Participation in vocational education with some concentration was found to be significantly more likely to be associated with employment in Holland realistic or Holland conventional jobs than was incidental participation or no participation in vocational education. As one considers patterns of participation in order of increasing concentration in vocational education, conventional jobs are a progressively larger share of all jobs held by participants who fit the pattern. Among the three concentrator patterns, the proportion of realistic jobs out of total jobs held by participants in any pattern declined by almost enough to offset the decline in the share of conventional jobs. Only Incidental/Personal and No Vocational Participation patterns displayed a different relationship between conventional and realistic jobs. The general educational development and specific vocational preparation needed for most of the jobs for which vocational education trains students can be accomplished within the present kindergarten to twelfth grade public education system. The majority of jobs for which vocational education prepares students were found to be in the lowest prestige category of Siegel's job-prestige scale and, for each gender, to have the lowest median earnings.

The largest single influence on labor market status was found to be the respondent's race. Being minority reduces the likelihood of being employed by nearly 28 percent. Most of the minority respondents were unemployed rather than out of the labor force (not looking for work). The next most important influence was found to be the respondent's sex. Being female was found to increase the likelihood of being out of the labor force by 21 percent, with females having no significant difference from men in being employed or unemployed. The three concentrator patterns of participation in vocational education were found to be associated with an increased likelihood of being employed and a decreased likelihood of being outside the labor force. But these estimated impacts were not statistically significant. The only statistically significant estimated effect found for the patterns of participation was that the three least intensively involved patterns reduce the likelihood of being in the labor force.

Incidental/Personal and Concentrator/Explorer participants were substantially less likely than Concentrators or Limited Concentrators to be in training-related employment. Concentrators had the highest likelihood of being in training-related employment. Vocational students with a specialty in the office and business area were more likely to be out of the labor force, whereas students trained in the trade and industry area were more likely to be in the labor force even after allowing for the effect of gender on labor force participation. Trade and industry specialists were more likely to be unemployed than were office and business graduates.

Regression equations allowing for the characteristics of jobs as well as background characteristics of the respondent were found to explain a significant portion of the variation in weekly earnings from its mean. Patterns of participation in vocational education only contributed in a statistically significant way to the explanation for women Concentrators. Among respondents with exactly twelve years of education who were not currently enrolled, white and minority women Concentrators earned, respectively, about twenty dollars and forty dollars more per week than respondents who took no vocational courses. When job characteristics were omitted from the equation, the total effect was estimated to be between twenty-five dollars and sixty dollars per week for women Concentrators. Male Concentrators and Limited Concentrators tended to have lower earnings than other not currently enrolled males who completed exactly twelve years of education, but the differences were not statistically significant.

Training-related placement for vocational participation was associated with higher weekly earnings for all respondents. But the estimates were not statistically significant. White males who specialized in agriculture reported significantly higher weekly earnings. Since most women in the sample who had a specialty were in the office area, the estimated effects for women Concentrators reflect primarily that area of specialty.

Policy should address itself to these primary concerns:

- Pride in craftsmanship, skill, and the impact of work on quality of life should be emphasized, especially where vocational education participants are likely to obtain jobs with lower pay or prestige.
- In matching the content of training to the needs of employers, vocational educators must strike a balance between the economy's short-run and long-run needs. Training programs should not sacrifice transferability in favor of immediate applicability of skills without carefully weighing the longer-term costs and benefits of a reduced capacity to respond to changing circumstances.
- Since vocational education can apparently mitigate but not overcome the adverse effects on employability of persons being in a racial minority, youth employment policy must continue to emphasize programs aimed at helping disadvantaged groups. The role of vocational education should be to aid in finding training-related placement for disadvantaged youth, a task that these data suggest is being performed well for mainstream youth.
- Effectiveness of any youth employment policy (and of any component of that policy associated with vocational education) depends heavily on a broader social context in which total employment opportunities are expanding. Any improvements in youth employment prospects that may arise from improvements in vocational education can be swamped by the adverse effects of inappropriate macroeconomic policies.

CHAPTER 1

INTRODUCTION

Increasing emphasis is being placed on how the task of training the nation's labor force should be accomplished. Secondary vocational education has historically played an active role in meeting the demand for skilled workers; preparing young people for employment has been a priority designated in the federal legislation since 1917. These factors create a situation in which the issue of the labor market effects of vocational education has become particularly relevant. Reliable information on the effects of vocational programs is a necessity for policymakers who must not only assess the impact of the current efforts in this area, but also determine the future direction of vocational education.

It is the purpose of this study to provide estimates of the effects of vocational education for high school graduates on the following four major aspects of the labor market experience:

- Job characteristics
- Labor force status
- Training-related job placement
- Earnings

The labor market activities of young adults were analyzed in the context of how various patterns of participation in vocational education influence their post-high school work experience.

Previous studies have also examined these questions and the findings have been mixed (Mertens et al. 1980). Although the reasons for such results could be many, one factor in particular has persistently plagued the evaluation of vocational education--the identification and classification of secondary curricula. The methods used to indicate high school curriculum have included self-report, administrator classification, and the counting of courses taken in various subject areas. Each technique has inherent advantages and disadvantages. However, when examining the possible relationship between vocational education and labor market outcomes, all three of these methods are generally regarded as unsatisfactory (Campbell, Orth, and Seitz 1981). In this report the high school transcripts of the respondents in the National Longitudinal Survey of Labor Market Experience (NLS), New Youth Cohort, were used to define vocational education. Information from the students' high school records permitted the use of a more descriptive classification method that reflects the variability of participation in vocational education.

This report is the second in a series of three reports. The first report used the NLS New Youth Cohort data plus the transcript data to identify and describe patterns of participation in secondary vocational education. This report analyzes the identified participation patterns in terms of certain labor market outcomes. The third paper will relate participation in secondary vocational education to various postsecondary educational activities.

Organization of this Report

The remainder of this chapter includes a literature review of the studies pertinent to the question addressed in this report. This is followed by a description of the scope of the report including a statement of the study's objectives and its limitations. A description of the NLS Youth data and the transcript data is provided in chapter 2. The chapter includes a discussion of the sampling and weighting processes, the type of data collected, and an explanation of how the subsample used for analysis was obtained. Chapter 3 discusses analytical requirements and the processes selected. Chapter 4 contains the results of the various analyses as related to employment/unemployment, training-related placement, and earnings. Chapter 5 contains a summary of the report, conclusions, and recommendations.

Literature Review

A review of the literature was conducted to identify any consensus regarding the various labor market outcomes of participation in secondary vocational education. The review is not intended to be exhaustive in nature, either in terms of the studies or outcome variables described. It focuses on analyses done using national longitudianl data, e.g., the National Longitudinal Surveys (NLS), the National Longitudinal Study of the Class of 1972, and Project Talent. For an extensive review the reader is referred to Mertens et al. (1980). Specific data for comparison with other studies are presented, as necessary, in the final chapter. The overview presented here is organized by the outcome variables being studied: employment/unemployment, training-related placement, and earnings.

Employment/Unemployment

The term employment is generally used by most researchers as it is defined by the U.S. Department of Labor: the state of being employed full-time or part-time. Unemployment is defined as the state of not being employed but looking for work. An individual's employment status is affected by such factors as the individual's academic aptitude, level of education, high school curriculum, vocational program, sex, race, economic conditions, and relatedness of area of high school training to employment.

Berryman (1980) and Copa and Forsberg (1980) indicated that verbal and mathematical skills affect employment, and vocational program graduates who acquired these skills had greater chances of obtaining employment than those who did not.

According to Mertens et al. (1980), some studies suggest that vocational preparation may confer a relative advantage during periods of high unemployment, but other studies find no differences in employment between vocational and nonvocational graduates.

Kaufman and Lewis (1972) found that the curriculum studied made no significant difference in unemployment but Berryman (1980) indicated that the likelihood of working at paid employment increased as more vocational hours were taken. However, she also found that vocational education programs do not increase employment of black youth.

Employment opportunities may be affected by a student's choice of vocational program area. According to Copa and Forsberg (1980) students who took trade and industrial courses had greater chances of finding paid employment than those in health occupations. Eninger (1972) stated that technical graduates enjoy the lowest unemployment rates. Economic conditions have also been found to affect the employment experience of high school graduates, including vocational graduates (U.S. Department of Labor, Bureau of Labor Statistics 1981).

Training-Related Placement

Training-related placement is affected by the availability of work in training-related areas, the students' vocational program area, the developmental stage of the graduates (career choice/decision), and the employer's perception of high school vocational curriculum.

Thurow (1979) argued that employers are generally not responsive to specific skills such as those produced by a vocational curriculum, but tend to hire those individuals with the ability to acquire job skills. Berryman (1980) supported this notion by stating that for male vocational graduates, the labor market is more of a market for training opportunities, rather than an opportunity to use previously acquired skills. This reasoning suggests a very limited role for secondary vocational education to play in conferring specific job skills. Thurow, however, conceded that some job skills such as nursing, teaching, and secretarial skills are typically acquired in formal training and "sold to a prospective employer." One would, therefore, expect placement rates to vary among vocational program areas.

Twenty-three studies of vocational education placement reviewed by Mertens et al. (1980) verified that over 50 percent of vocational graduates are employed in occupations related to their training. Higher rates of related placement were associated with health and business and office graduates. Consistent with that conclusion regarding business and office training, Grasso and Shea (1979b) stated that females are more apt to work in jobs associated with preemployment training. On the other hand, Conroy (1979) found that trade and industry area graduates (who tend to be men) are more likely and office area graduates less likely to find training-related placement within their first six years following high school graduation.

Earnings

Considerable attention in educational research has been given to the effect of vocational preparation on earnings. Despite the potential reliability problems with self-reported earnings data (Conger, Conger, and Riccobono 1976; and Pucel and Luftwig 1975), numerous studies have been conducted on hourly, weekly, monthly, and annual earnings. For this review, the findings from various earnings studies are partitioned according to four major issues--differences between vocational and nonvocational students, differences by sex and race in the effect of high school curriculum, differences among the vocational program areas, and differences between persons in training-related jobs and those in unrelated jobs.

Vocational/nonvocational program influences. No consensus exists on the effect of high school curriculum on earnings. In an extensive summary of the studies concerned with the effects of vocational education, Mertens et al. (1980) reported mixed results for earnings. Some studies showed no significant differences in earnings between vocational and nonvocational graduates; these studies include Burgess (1979), Copa, Irwin, and Maurice (1976), Herrnstadt, Horowitz, and Sam (1979), and Katz, Morgan, and Drewes (1974). Other studies reviewed by Mertens indicated that vocational students did enjoy an earnings advantage over nonvocational students but that this advantage disappeared over time (Hu et al. 1968; Market Opinion Research 1973; and Swanson 1976). In a similar review of studies that used longitudinal data, Grasso and Shea (1979a) found that with adjustments for academic aptitude, the Project Talent data showed that the earnings gap between general and vocational curriculum males was less than five cents an hour five years after graduation. They also reported that the Class of 1972 data yielded positive earnings effects for vocational students but that the differences were neglible.

Wiley and Harnischfeger (1980) also found that the effects of educational programs varied over time. In the Class of 1972 data, vocational students reported higher hourly and annual earnings than students from other curricula in the first year following graduation. Analyses of data from the 1976 follow-up indicated that vocational students still benefited from an earnings study using the Class of 1972 data found no significant relationship between initial wage rates and wage rates four years after graduation (Meyer and Wise 1979). This study analyzed the earnings data for males only and used a different indicator of curriculum than Wiley and Harnischfeger. Conroy's (1979) study based on the Class of 1972 data reported that vocational graduates who did not attend college earned more than their nonvocational peers during the first year after graduation. However, it was suggested that the differences were more closely related to academic ability than to secondary curricula.

Influences of sex and race. In the review of results from the national surveys Grasso and Shea (1979a) found some differences according to sex in the effect of high school curriculum on earnings. For males enrollment in a secondary vocational program was found to be unrelated to the hourly rate of pay and to annual earnings. There was also evidence that male vocational graduates had slower rates of growth in earnings than did general graduates. However, higher rates of pay and higher annual earnings were found for females with a business and office background when compared to females from a general curriculum.

Similar results were identified for males and females in a review of studies by Berryman (1980). She suggested that employers would prefer to hire males with developed skills but that employers do not pay wage differentials on this basis because they do not always have a way to assess the quality of the employees' training. On the other hand, employers often regard females as high turnover employees for whom they cannot recoup training costs. Hence, employers are more conscious of, and pay for, differences in prior training among women. Alternatively, it may simply be easier for employers to assess typing and other office skills used in traditionally female jobs than it is to assess vocational skills used in traditionally male jobs.

The effect of race on earnings was often found to be related to sex. For example, a preliminary analysis of the NLS Youth data showed that minority males and minority and white females who had vocational training exhibit an advantage in hourly earnings over their general program peers. White males who had vocational training, however, were found to have lower hourly earnings than white males from general or college preparatory curricula (Borus et al. 1980). In contrast, Grasso and Shea (1979b) found that, although the results were not statistically significant, black males with vocational training consistently reported lower hourly earnings than black males from a general program.

Program area influences. Mertens et al. (1980) identified a number of studies that focused on earnings within the vocational education program areas. These studies were diverse in terms of the manner in which the subgroups were designated, the time period after leaving school that was considered, and the composition of the sample being studied. For these reasons any generalization is tentative. The results did show, however, that the students from trade and industry program area were most frequently found to have the highest earnings. In addition, Borus et al. (1980) found that black females and white males with a business and office background, and Hispanic males with training in the trade and industrial program, enjoyed a significant economic advantage over vocational graduates from other program areas.

Earnings in training-related placements. Three studies identified by Mertens et al.(1980) focused on the association of earnings and training-related placement. In the Project Metro study small differences in hourly wage rates were identified for vocational education graduates employed in jobs related or unrelated to their training (Eninger 1972). Technical graduates in jobs related to their training earned more per hour whereas home economics graduates earned less per hour than their peers in unrelated jobs.

In the second study, the only significant result was for distributive education students six months following graduation. Those students in related jobs earned significantly less than those in unrelated jobs (Richardson and McFadden 1975).

In the third study, Loeb (1973) found that persons in related occupations averaged a slightly higher hourly rate of pay than persons in unrelated occupations. This comparison applies to students' first full-time job after graduation. The relationship was reversed, however, when earnings were examined for the job held at the time of the interview.

In conclusion, the literature shows that the labor market experiences of young adults are affected by many diverse factors. No consensus exists regarding the effects of high school curriculum on earnings or employment status. But there is evidence that whatever effects may be present vary with the race and sex of the participant and from one vocational program area to another. There is some degree of consensus that, among vocational students, those who specialize in the trade and industry area seem to have higher employment rates, lower unemployment rates, and higher earnings. Previous research efforts also provide ample evidence that the evaluation of employment, job placement, and earnings experiences is not a straightforward affair. In addition to the influences discussed in the review, factors such as socioeconomic status, unionization, and work experience may affect any one or more than one of the outcome variables of interest. The remainder of this chapter will present a model that may be useful in unraveling these various effects in order to understand more fully the processes that operate and influence participation in the labor market.

Scope of the Report

Specifically, to understand the contribution that secondary vocational education is expected to make to labor market participation, it is necessary to take into account the complex network of interactions through which the contribution has to occur.

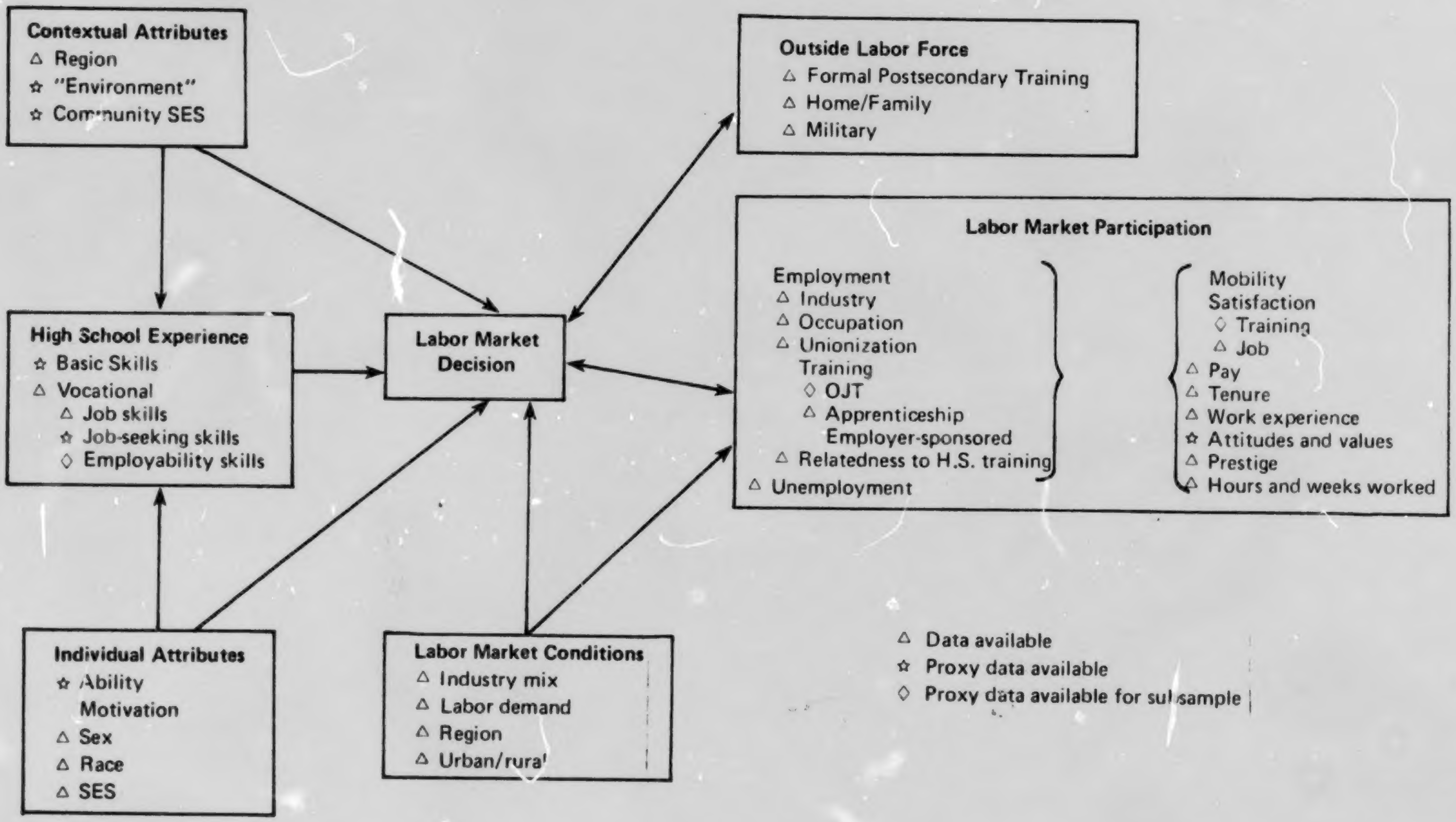
A schematic representation of one model of this network is presented in figure 1. Three categories of elements are presented in the diagram. They are influences, experiences, and decision points. Although there is not an inviolate temporal or causal ordering in the process, a reasonable place to begin consideration of the network is at the point of high school experience. It is at this point that two sets of influences come to focus that may alter the vocational education experience sufficiently to be transmitted to the labor market decision point, and thence to the labor market.

The high school experience itself includes both training and informal learning in academic skills, basic skills, and vocational skills. The nature of the high school experience is influenced by two primary sources: the attributes that the individual brings to the experience and the contextual attributes of the school itself. These two sources of influence also impinge directly and independently upon the labor market decision point, thereby contributing to decision variability regardless of the quality of the high school experience.

Among the individual attributes that are expected to influence the high school and labor market experiences are ability, motivation, sex, race, and individual and family socioeconomic status (SES). Some of these attributes are judged to be potentially modifiable by experience, others are not. The contextual variables include region of the country, community socioeconomic status, and other local environmental conditions. Because only the local environmental conditions may be amenable to alteration, they become of primary interest. Geographic region and community SES may help explain high school and labor market experience but cannot be reasonably or practically manipulated to change either. Identification and measurement of the local conditions, such as community attitude toward the work ethic and individual responsibility are, however, extremely difficult and complex.

FIGURE 1

VARIABLES INFLUENCING LABOR MARKET BEHAVIOR


Contextual Attributes
△ Region
☆ "Environment"
☆ Community SES
High School Experience
☆ Basic Skills
△ Vocational
△ Job skills
☆ Job-seeking skills
◇ Employability skills
Individual Attributes
☆ Ability
Motivation
△ Sex
△ Race
△ SES
Labor Market Decision
Labor Market Conditions
△ Industry mix
△ Labor demand
△ Region
△ Urban/rural
Outside Labor Force
△ Formal Postsecondary Training
△ Home/Family
△ Military
Labor Market Participation
Employment
△ Industry
△ Occupation
△ Unionization
Training
◇ OJT
△ Apprenticeship
Employer-sponsored
△ Relatedness to H.S. training
△ Unemployment
Mobility
Satisfaction
◇ Training
△ Job
△ Pay
△ Tenure
△ Work experience
☆ Attitudes and values
△ Prestige
△ Hours and weeks worked
△ Data available
☆ Proxy data available
◇ Proxy data available for subsample

Consequently, in most analyses, a substantial proportion of these attributes remain unexplained in the residuals.

The central axis in the vocational education/career network is the labor market decision point. In addition to being influenced by individual attributes and other contextual attributes, the characteristics of the labor market itself may also exert a major influence upon the decision. Likewise the requirements or availability of postsecondary education, home and family activity, military training, and other nonlabor market activities will influence the decision. When the decision to enter the labor market is made, the two possible results are employment and unemployment. Which of these two alternatives occurs is also heavily influenced by the high school experience, the effects of individual and contextual attributes through this experience, and the effects of these latter two attributes directly.

The labor market conditions that influence the decision also influence directly the employment/unemployment results of the decision. If the result is continued unemployment, initial decisions are likely to be periodically reevaluated, with possible nonlabor market outcomes. If, on the other hand, employment results, there are characteristics of employment that may be influenced by the high school vocational education experience--characteristics that must be accounted for before there can be adequate explanation of the relationships. These characteristics themselves tend to be interdependent and overlapping. Assessing them is therefore difficult. Nevertheless they cannot be ignored. They include the nature of the industry, the nature of the occupation, the presence of unionization, the availability of training--on-the-job, apprenticeship, or employer-sponsored--and the relatedness of the employment to the high school training experience. Finally, there are a series of attributes of the job or career that may be influenced by secondary vocational education, but may only be evaluated through employment. These include mobility, satisfaction with training and job, pay, tenure, work experience, attitudes and values, prestige, and time worked.

Figure 1 also shows the state of data availability for the NLS sample, classified by its degree of directness. The analyses undertaken in this study are therefore constrained to deal with only part of the network because data are not available for all of the potentially relevant variables.

Specifically, the study will deal with the labor market outcomes of rate of pay, employment/unemployment, relatedness of employment to training, and degree of labor market participation. These will be considered in the context of controls for race, sex, socioeconomic status, variation in the labor market, and variation in vocational education participation. Labor market variation includes region of the country and type of employment. Although not the major thrust of the study, the interactions of the contextual variables with the labor market, independent of vocational training, will be presented where they clarify understanding of the milieu in which vocational education has its effects.

CHAPTER TWO

DESCRIPTION OF THE DATA

The data used for analysis in this study were taken from the combined National Longitudinal Survey of Youth Labor Market Experience (NLS Youth) and the high school transcripts of a subsample of the NLS panel. The Center for Human Resource Research (CHRR), with support from the U.S. Departments of Labor and Defense, initiated the NLS Youth data collection in 1979. At the time of the first interview the participants in the survey were asked to sign a release permitting the disclosure of their high school transcripts. In 1980, with funding from the U.S. Department of Education, Office of Vocational and Adult Education, and under a collaborative agreement with CHRR, the National Center for Research in Vocational Education obtained the high school records of the NLS Youth respondents who were seventeen years of age or older at the time of the first interview.* The merger of the two data sources provides a cost-effective and unique information base to examine the course-taking behavior of secondary students and to better evaluate the post-high school labor force activities of youth.

Description of the NLS Youth Cohort

The 12,686 persons included in the NLS Youth sample were selected by a household screening process in the fall of 1978; the New Youth Cohort represented a national probability sample of youth between the ages of fourteen and twenty-one when originally selected. The sample was drawn in three stages: a cross-sectional sample; a supplemental sample of blacks, Hispanics, and economically disadvantaged whites; and a sample of young persons serving in the military. Both the cross-sectional and supplemental samples were stratified by sex in order to obtain relatively equal proportions of men and women. Because blacks, Hispanics, and economically disadvantaged whites are purposefully overrepresented in the NLS Youth sample, a weighting procedure was developed to permit more accurate estimates of these various combinations of the youth population.* Approximately 2 percent of the NLS respondents are Native Americans or of Asian or Pacific Island descent; these minority members are classified as white in the survey.

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* The transcripts of respondents who were fifteen and sixteen at the first interview are being collected in the current contract year. Plans to collect the transcripts of respondents who were fourteen at the first interview are underway.

Extensive background information about family, schooling, work history, and training was gathered for all the respondents in the NLS Youth Survey when they were first interviewed early in 1979. In addition, data on current educational and labor market activities were obtained. The first follow-up interviews were conducted in 1980. The rate of attrition in the second round of the survey was 4.3 percent, yielding a sample size of 12,134. Follow-up interviews are scheduled with the participants in the New Youth Cohort through 1984.

NLS Youth Transcript Collection Effort

The transcript collection effort was initiated through a subcontract let by the National Center for Research in Vocational Education to the National Opinion Research Center (NORC) to secure and code the transcripts of the NLS Youth respondents. The target sample for the data collection, which was conducted in 1980, was youth seventeen years and older at the time of the 1979 NLS interview (N = 8,420), 94 percent of whom had given permission to collect their transcripts. Persons excluded from the transcript collection were those less than seventeen years of age who presumably had not completed secondary school, persons in the military sample, and youth in foreign high schools. With several follow-up efforts, including additional mailings, telephone checks with school officials, and on-site data collection, a 77 percent response rate was achieved. If a student had transferred and the original school's transcript was not complete, extensive efforts were made to locate and contact the new school to obtain the student's record.

The coded information, if available from the individual transcripts, included: (1) days absent, grades nine through twelve; (2) academic rank in class; and (3) math and verbal scores for aptitude tests (Preliminary Scholastic Aptitude Test,

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* For a full description of the sampling and weighting procedures used in the survey and a descriptive analysis of the first year's data, see Borus et al., Youth Knowledge Development Report 2.7 Findings of the National Longitudinal Survey of Young Americans, 1979 (1980).

Scholastic Aptitude Test, American College Test). Course information included the specific course taken, the grade (or year) in which the course was taken, the letter grade received, and the credit received for the course. Each course credit was converted to a common scale, the Carnegie credit unit, at the time of coding. This system assigns 1.0 credit to a standard full-year course, or one course taken one hour a day for 180 days. The Carnegie credit-unit system provides a method that is sensitive to the length of time spent in the classroom, contrasted to a simple count of courses taken, thus facilitating a comparison of the youths' vocational education experiences on a national level. A coding system to identify the actual courses taken by the student was developed from the Standard Terminology for Curriculum and Instruction in Local and State School Systems Handbook VI (Putnam and Chismore 1970). The course identification scheme consisted of a two-digit, subject matter prefix (e.g., math, English) followed by a two-digit code, which specified the individual course within the general category (e.g., Math I, American Literature).

The seven subject matter areas identified as "vocational" in Handbook VI were used in this study. These categories are agriculture, distributive education, health occupations, home economics, office occupations, technical education, and trade and industrial occupations. Several decision rules were adopted to accommodate the available data and refine the definition of vocational education. Technical education and trade and industrial courses were combined and designated as trade and industrial. Only courses considered to be vocationally oriented were included in the home economics classification, contrasted to homemaking or consumer home economics. In addition, business and industrial arts courses were differentiated from office occupations and trade and industrial courses and were not considered vocational. In general, business and industrial arts courses are directed toward the acquisition of knowledge and skills that are intended for personal use rather than for occupational training.

Description of the Data Used for this Study

The proposed focus for this research effort, examining the labor market effects of secondary vocational education, suggested that several methodological considerations should be taken into account in the selection of a subsample to be used for analysis. A primary objective was to maximize the number of cases included and yet preserve a relatively homogeneous sample in terms of labor market opportunities and exposure to vocational courses and programs. For example, it would be inappropriate to treat high school graduates and dropouts as an aggregate given the possible effect of credentialing (i.e., having a diploma) on labor market experience. In addition, the method by which vocational education is measured in this study is dependent upon the information available from students' transcripts. Another factor concerned the demographic distribution of the subsample and the generalizability of the results in terms of the youth population.

To accommodate these factors and to obtain an appropriate subsample for the analyses, the following decision rules were applied to the data. Only civilian respondents who had reported completing high school were used in the analysis (N = 5,008). Recognizing that students have different reasons and motivations for remaining in school, this strategy provided a common denominator with which to examine the labor market experiences of youth. Whenever possible the level of education was controlled in order to gauge the influence of postsecondary schooling on labor market outcomes. The measure of educational attainment was based on the 1980 NLS interview.

The sample was then limited to respondents who had transcripts with course information for grades nine through twelve (N = 3,056). Because the measure of vocational experience was derived from the information on the transcripts it was necessary to screen the high school records and eliminate cases that did not have adequate data for each grade. The restrictions placed on the selection of the cases facilitated more precise estimates of vocational education participation and subsequent labor market outcomes.

Approximately 60 percent of the persons included in the sample had completed exactly twelve years of education. The remaining 40 percent of the sample were enrolled in a postsecondary institution as of the 1980 interview and had completed between thirteen and sixteen years of schooling. The sample used for analysis consisted of approximately 48 percent males and 52 percent females. Eighty-seven percent of the sample were white, 9 percent of the respondents were black, and approximately 4 percent were Hispanic.*

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* The weighted percentages are reported. The sampling weights function to bring the reduced sample "back into line" and allow it to be generalizable to the target population of secondary graduates. For more detailed information concerning the characteristics of the sample the reader is referred to Campbell, Orth and Seitz, Patterns of Participation in Secondary Vocational Education, Columbus, Ohio: The National Center for Research in Vocational Education, The Ohio State University 1981.

A comparison of the sex and race data and independent population estimates of high school graduates within the specified age range showed the NLS subsample contains a slightly higher proportion of males and whites (approximately two percentage points). Assuming, however, that the additional cases will be proportionally distributed among all categories, these discrepancies will not substantially affect the findings. Examination of the selected subsample by sociodemographic variables such as geographic region, rural and urban residence, and family socioeconomic status revealed that the data, in general, provide a representative information base which can be used to investigate the effects of secondary vocational participation.

Whenever possible the entire sample of high school graduates was used for analysis. However, partitioning of the sample was required in some cases in order to examine particular labor market issues. For example, the question regarding training-related job placement is not relevant for persons who did not participate in vocational education or did not accrue enough credits in one program area to develop a specialty. The details concerning how the sample was selected for each of these analyses are presented where appropriate.

Variables Used in the Analysis

To permit the reader a complete understanding of the subsequent analysis and findings, a brief description of the variables used in this study is warranted. Variables such as sex, race, marital status, and the years of schooling completed are straightforward. Other variables, such as the classification of vocational education students, are unique to this study and merit further elaboration. Except where indicated, the data used for this study are from the 1980 NLS interview and transcript data.

High School Experience

Because the primary concern of this research effort is to examine the labor market effects of secondary vocational education, the method by which former vocational students were identified is crucial. The classification method used in this study extends beyond the traditional self-report of high school curriculum and reflects the variability of vocational participation. Using the NLS transcript data, five patterns of vocational participation were developed and were used as indices of involvement in vocational programs (Campbell, Orth, and Seitz 1981).

The patterns of participation were developed by (1) operationalizing five descriptive concepts that reflected different aspects of vocational participation; (2) utilizing the five descriptive concepts to formulate a target profile for each of the proposed pattern types; (3) matching the actual profile scores obtained from the student's transcript to the target profiles; and (4) assigning the individual cases to the appropriate pattern type.

Briefly, the descriptive concepts include: (1) the number of credits received in vocational courses in the program area of specialization; (2) the number of program areas in which vocational courses were taken; (3) the number of years in which the specialty was pursued; (4) the number of vocational credits in the program area that were determined to be supportive of the specialty area; and (5) a scaled measure of whether the specialty was pursued in the eleventh and/or twelfth grade. A student's area of specialization was defined as the program area (i.e., distributive education, home economics) in which at least six-tenths of the total number of vocational credits were received.

These descriptive concepts were used to construct target profiles. The target profiles represented the hypothesized most likely set of scores associated with each pattern type. The transcript record was used to obtain a profile of scores for the descriptive concepts for each student. The actual case profiles were then compared to the target profiles, and assignment to a pattern was based on the Euclidean distance function. A case was assigned to the pattern type from which it had the least distance. The five patterns were labeled Concentrator, Limited Concentrator, Concentrator/Explorer, Explorer, and Incidental/Personal and were ordered by the degree of involvement in vocational education.

For example, Concentrators take an average of six vocational credits over a three-year period. Limited Concentrators generally take about half the number of vocational credits as Concentrators, usually within a two-year span. The next pattern group, Concentrator/Explorer, is similar to the Limited Concentrator pattern except the vocational course work is usually completed early in the high school years. Students classified in the Explorer pattern pursue courses in three or more program areas but do not achieve any level of specialization. In comparison, Incidental/Personal students average less than a full credit and generally completed the work in a semester.* These patterns were used in the analyses in place of the traditional curriculum descriptors of vocational, general, and college preparatory.

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* For a full description of the methodology and techniques used to construct and validate the patterns of participation variable, the reader is referred to Campbell, Orth, and Seitz, 1981.

Individual Attributes

The socioeconomic status (SES) variable was derived using four intercorrelated indices of family background. The variables used to construct SES include (1) a measure of the family learning environment at age fourteen (i.e., whether newspapers and magazines were received regularly and if persons in the household had a library card), (2) mother's educational attainment, (3) father's educational attainment, and (4) father's (or mother's if the father was absent) occupational prestige score when the respondent was fourteen years of age. Principal components analysis was used to obtain the appropriate weights for each of the variables and the weights were used with the standardized scores to secure a composite SES score for each respondent.

The other individual attribute variable used in the study was ability. This variable was measured using the respondent's academic rank in class as a proxy.

Labor Market Conditions

The unemployment rate for the area in which the respondent lived was used here as a proxy for labor demand. If the respondent resided within a Standard Metropolitan Statistical Area (SMSA), the unemployment rate for the SMSA was used. The unemployment figure for the rest of the state was used if the place of residence was non-SMSA. Data were obtained from Employment and Earnings (U.S. Department of Labor, Bureau of Labor Statistics 1979).

The four major geographic regions, as defined by the census, are used in this report in order to exercise some degree of control over the different employment and industrial conditions in various areas. The regions identified were the Northeast, North Central, South, and West.

Recognizing that the industrial composition of an area is influenced by the extent of urbanization, a variable indicating urban or rural residence was also included. Using data from the City and County Data Book (U.S. Department of Commerce 1972), the percentage of the urban population in the county of residence was employed as a measure of an urban or rural environment. If the county was less than 50 percent urban, the respondent was considered to reside in a rural area.

Labor Market Participation

The current labor force status of individuals in the sample was determined by using the Current Population Survey technique of asking what the respondent was doing "most of last week." If individuals responded that they were either working, had a job but were not at work (i.e., on lay off, vacation, and so forth), or were looking for work, they were considered to be in the labor force. Responses such as "keeping house, going to school, or unable to work" resulted in the respondent being classified as out of the labor force. Persons who were going to school and also working were placed in the "in the labor force" category.

Analysis was conducted using data for the current job if an individual was reported to be currently working. If at the time of the interview, the respondent was unemployed or out of the labor force, under certain conditions, variables such as hourly rate of pay, hours worked per week, job tenure, and unionization were based on the data for the last job. Information regarding the last job held was used only if the respondent had left the job within three months of the interview date. Application of the three month decision rule enhanced the timeliness and reliability of the job information. The age range of the sample (seventeen to twenty-three) was broad enough to suggest that the jobs held by the respondents were not always equivalent. Some persons were starting college and working part time. Others had entered the labor market immediately following graduation. Therefore, whenever possible, control variables such as current enrollment status and educational attainment were used.

Two additional variables were derived using the data for the current or last job. Work experience was defined as the number of months between the date of graduation and the 1980 interview date if the respondent was employed, or the job ending date if the data from the last job were used. This variable measured the time available for labor force participation rather than the actual time spent on the job. The second variable, the relatedness of high school vocational training to the occupation, was determined by comparing the respondent's area of vocational specialization (i.e., trade and industry, agriculture) to the occupation of the current or last job. The occupational and educational code crosswalk developed by the National Occupational Information Coordinating Committee (1979) was used to link the vocational program areas and the three-digit census occupational codes. If the occupation reported by the respondent matched one of the occupations identified under the particular program area, the respondent was considered to be in a training-related position.

The data and the variables previously described have been used in this report to examine the labor market experience of young adults and to ascertain the possible effects of secondary vocational education. The specifics as to how the variables are used in the various analyses are discussed where appropriate. Chapter 3 presents a discussion of the analytic techniques used to address the research questions and the findings of the analyses.

CHAPTER THREE

ANALYTIC PROCEDURES

The purpose of this research activity is to consider the effects of secondary vocational education on labor market behavior. These effects occur in a context that not only modifies the nature and quality of vocational education but also determines in significant ways the nature of the labor market in which the vocational education graduate must participate. To understand the impact of vocational education effects it is therefore necessary to account for a large number of contextual variables. They include such individual characteristics as race, sex, region of country, and level of socioeconomic status. Although some of these variables are measurable on continuous scales, most are not. Further, the large number of possible sources of variation in the individual's life context, the labor market, and in vocational education itself forces the investigator to search for parsimony if understanding is to be achieved. In addition, to be useable for policy considerations, the effects must be presentable in as straightforward a manner as possible. These conditions and constraints suggest the nature of the analytic approach to be taken.

Methods for Categorical Data

The elegant simplicity of a cross-tabulation presenting comparative percentages is the analysis of choice whenever the nature of the data permit such a simple presentation. Some results of this research, such as the relationships between prestige of jobs and areas of specialization can be evaluated and presented in this way. As the number of variables to be considered increases beyond two or three, however, more complex analysis is required.

One promising method of analysis for categorical data that has been developed in recent years is the log-linear analysis of multiway tables. The applicability and limitations of the log-linear approach have been presented in a growing body of literature (see, for example, Knoke and Burke 1980; Marks 1975; and Brown 1975). Briefly, the method is designed to compare a series of hierarchical models to permit the selection of a parsimonious one that explains the data with satisfactory precision. The technique then provides an estimate of the relative effects of the parameters of interest through their contribution to the expected cell frequencies.* The model-fitting phase of the log-linear analysis is accomplished through iterative fitting of expected frequencies that satisfy the marginal totals of the tabulated cross memberships in the categories. The method of fitting used in this research was the iterative proportional fitting algorithm incorporated in the Biomedical Computer Programs (Dixon and Brown 1979) and attributed to Haberman (1972).

Model selection is accomplished by first securing an estimate of the expected cell frequencies and their goodness of fit to the actual data, for a series of successively higher order models of full order up to a saturated model. (A saturated model contains all of the main effects and interactions among the variables describing the table. It will reproduce expected frequencies that exactly match the observed frequencies in the table.) A series of significance tests is provided, showing whether successively higher orders of interaction are necessary to adequately account for the actual frequencies. The results of this test suggest the level of complexity of the most parsimonious model that will adequately account for the data.

The second series of tests removes each main effect and interaction out of the saturated model, one at a time, and tests whether a significant difference between the full model and the reduced model is produced. The resulting levels of significance may be used to suggest which interactions must be included in the parsimonious but adequate model.

After reviewing the significance tests from the previous stage, promising models may be identified for confirmation in the model selection phase of the analysis. The significance tests for this analysis are the same type as those used to test the full order models. When an appropriately significant model is reached, the expected frequencies are produced together with the multiplicative and additive parameters. These parameters have the property of expressing the part of the expected frequency in each category of the table that is due to the effect represented by the parameter. The relationship may be expressed, as an example, in the following equation:

$$F_{ij} = \eta \, \tau^A \, \tau^B \, \tau^C$$

where F_{ij} = expected frequency in cell ij
η = a constant for all cells
$\tau^A \; \tau^B \; \tau^C$ = the respective effects of A, B, and C

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*This discussion is not intended to describe in detail the application and rationale of log-linear methods but rather to document the steps taken in conducting the analysis reported herein.

Suppose that B represents the variable sex. If it makes no difference whether a person is male or female in relation to some other variable of interest, then the τ parameter for both sexes will be one, and the frequency in cell F_{ij} will not contain any component due to sex, because the obvious result of multiplying the other terms of the equation by one is no change. If, on the other hand, there is an effect for sex, the value of τ will be greater or less than one, depending on the direction of the effect for the sex represented in any specific cell. This value will increase or reduce the product of all the other terms that contribute to the cell frequency. This multiplicative parameter may be converted to a percentage by subtracting one and multiplying by one hundred, thereby expressing the effect of the variable of interest on the expected cell frequency in percentage terms.

The additive form of the parameters is simply the natural log of the multiplicative form. Estimates of the variance of the additive parameters are available and may be used to produce z-tests of the significance of each effect.

Although it is possible to perform log-linear analyses of the asymmetrical, or logit, form (see for example, Knoke and Burke, 1980) the approach becomes quite complex when the intended dependent variable is polytomous rather than dichotomous. Therefore the method as used in this study was interpreted in a symmetrical manner. Attention was focused upon the contribution of the specific antecedent variables of interest to the marginal totals of labor market outcomes, which were represented by either three or four categories.

The limitations of this analytic approach are discussed at some length in Knoke and Burke (1980) and Gillespie (1977). The greatest practical limitation has been the necessity to reduce categories to avoid empty cells. However, the clear-cut interpretation of complex relationships more than offsets this disadvantage. Where the outcome data of interest were clearly categorical, this analytical method was utilized in the present research.

Methods for Continuous Data

Other kinds of data available in NLS were measured on a continuum to the degree that suggested that the use of regression analysis was appropriate. Several sets of equations were run that took into account explanatory variables including those used in the log-linear analysis. These were treated as dummy variables when they were categorical in nature. Regression was the analysis of choice when hourly and weekly rates of pay were the labor market outcomes of interest.

The standard simplifying assumption in such analyses is that this outcome function is linear or log-linear in its determinants:

$$(1)\ Y_i = a + bX_i + cE_i + dJ_i + e_i$$

where Y_i = earnings (or another outcome variable), in standard form or in natural logarithms, of the i^{th} individual in the sample.

X_i = a vector of individual and contextual attributes, labor market conditions, and work history of the i^{th} individual.

E_i = a vector of measures of educational attainment.

J_i = a vector of job characteristics pertaining to the i^{th} individual.

e_i = a random disturbance term representing all unobserved influences on Y.

As theory and analytical techniques have developed, the specification of E has changed. In the early human capital models, E was simply the number of years of education acquired. The use of quality as well as quantity of education followed the collection of new data sets. The principal emphasis then was on quality and quantity of higher education. Recently, as policymakers became aware of the gravity of the youth unemployment problem, greater attention has been focused on high school education. Largely because of the form of data collected for the National Longitudinal Surveys of Labor Market Experience, the usual form of cE has been:

$$(1a)\ cE_i = c_v VOC_i + c_a CPREP_i + c_g GEN_i + c_h HIGH_i$$

where VOC_i = 1 if the i^{th} individual classified his high school course work as primarily vocational

$CPREP_i$ = 1 if course work was primarily college preparatory

GEN_i = 1 if course work was neither vocational nor college preparatory

$HIGH_i$ = some measure of quantity and/or quality of postsecondary education

When equations of the form of (1) are estimated, they are normalized on students taking a general curriculum, so that estimates are obtained not for c_v, c_a, c_g, and c_h, but for (c_v-c_g), (c_a-c_g), and (c_h-c_g), the differences of the specific curriculum effects from the effect of a general curriculum.

In this study, no distinction is drawn beween college preparatory and other academic (i.e., nonvocational) high school course work. Thus, the education variable takes the form:

$$(1b)\ cE - c_o\ NOVOC = (c_c - c_o)\ CONC + (c_{lc} - c_o)\ LCON + (c_{ce} - c_o)\ CONEX + (c_{ip} - c_o)\ INPER + (c_e - c_o)\ EXP + (c_h - c_o)\ HIGH$$

where $CONC_i$, $LCON_i$, $CONEX_i$, $INPER_i$, and EXP_i show, respectively, the participation profiles into which a respondent is classified. The symbol "NOVOC," and its corresponding coefficient, c_o, identify the normalizing class, in this case students with no credit hours in vocational courses in high school.

One must be careful here to distinguish between direct, indirect, and total (the sum of direct and indirect) effects of vocational education. As indicated in the chapter 1 discussion of figure 1, the vector J_i in (1) includes characteristics of the job that are, themselves, outcome variables affected by vocational education. That is, instead of a single equation for each outcome there may be a system of equations:

$$(1)\ Y_i = a + bX_i + cE_i + dJ_i + e_i$$
$$(2)\ J_i = f + gX_i' + hE_i + u_i$$

E affects Y both directly in equation (1) and indirectly, through its effect on J. One could attempt to estimate the structural equations (1) and (2) or the reduced form equation:

$$(1c)\ Y_i = (a + df) + (b + dg)X_i + (c + dh)E_i + (e_i + du_i)$$

The reduced form equation provides estimates only of the total effect of vocational education, c + dh. Unless X' includes some elements that X does not, equation (1) is not identified, and direct effects cannot be estimated separately. Unfortunately, the current state of the theory of the effect of vocational education on labor market outcomes offers no guidance as to whether equation (1) can be identified. Hence, forms of both (1) and (1c) have been estimated. One can assume that e_i is distributed normally with zero mean. However, u_i will not be distributed normally if J_i is a discrete rather than a continuous job characteristic. If u_i is truncated normal, $e_i + du_i$ will be approximately normal, and one can reasonably expect that coefficients in (1c) can be estimated by ordinary least squares (OLS) without a significant distortion of their estimated variances.

One should also note that if equation (2) is made slightly more general, OLS estimation of (1) may be subject to simultaneous equation bias. Suppose, for instance, that (2) should actually be:

$$(2a)\ J_i = f + gX_i' + hE_i + jY_i + u_i$$

Then J_i in (1) correlated with e_i, Y_i in (2a) is correlated with u_i, and OLS estimation of either (1) or (2a) is inappropriate. The advantage of estimating (1c) rather than (1) or (2a) individually is that 1c's estimation is not affected in this case. For the sake of comparison, OLS estimates of (1) and (2a) are presented and discussed in the following paragraphs.

Finally, in a recent unpublished note John Bishop, a colleague at the National Center, has pointed out another possible source of estimation problems. In the framework set out previously, Bishop's point is illustrated by observing that the complete system may be:

$$(1)\quad Y_i = a + bX_i + cE_i + dJ_i + e_i$$
$$(2)\quad J_i = f + gX_i' + hE_i + u_i$$
$$(3)\quad E_i = j + kX_i'' + v_i$$

Although the structure does not impose a simultaneity bias on the system, problems will arise if e_i and v_i are correlated. That correlation is plausible if the unobserved characteristics that lead an individual's earnings to be abnormally high (or low) are the same ones that influence educational choices. In this situation the bias arises from the process that selects students into various high school curricula.

Both of these last two sources of possible estimation problems will be dealt with in subsequent papers, as they extend beyond the scope of the present research.

The estimation method employed varies according to the type of dependent variable in the regression equation. Equations for hourly or weekly earnings are estimated by ordinary least squares. Equations are estimated for both the dollar amount of earnings and its natural log. All estimates are made with unweighted observations, since a correctly specified regression model should not require weighting to correct for stratification of the sample. Since studies reviewed in chapter 1 suggested that race and sex may affect slope coefficients as well as intercepts, the equations presented here are run for four subsamples that are partitioned according to race and sex.

Using these three methods of analysis, cross-tabulations, log-linear analysis, and regression analysis, the labor market effects of secondary vocational education were studied. As the results are presented in the next section, the details of the particular analytic method will be expanded as necessary to present the basis for the findings.

CHAPTER FOUR

ESTIMATES OF VOCATIONAL EDUCATION EFFECTS ON LABOR MARKET OUTCOMES

The analysis of the labor market effects of vocational education, as discussed earlier in this paper, requires consideration of data from qualitatively different sources measured in constructually different ways. The results for those data that tend to be more qualitative and categorical are presented in the first two sections. The results for those data that were analyzed in a more conventional quantitative way are presented in the third section.

Previous work in the labor market effects of vocational education, reviewed in chapter 1, as well as conventional wisdom, suggests that the graduates of vocational education are prepared to compete in a segment of the labor market that is limited in range and scope. To verify or disconfirm these perceptions with the present data, an analysis was undertaken to determine the outlines or controlling tendencies of the segment of the labor market into which the vocational education graduates seemed to be moving.

Characteristics of Jobs Held by Vocational Education Participants

Holland's (1973) system of job classification was used for describing this segment of the labor market. Holland's classification system is an integral part of his theory of careers, which was originally designed as a tool for vocational guidance and counseling. The system is a typology of personality types and work environments; the typology is useful here because it communicates descriptive information about the nature of the labor market into which young adults enter. According to Holland, jobs are classified on the basis of their resemblance to six ideal types of work: realistic (R), investigative (I), artistic (A), social (S), enterprising (E), and conventional (C). A short description of these six categories, and sample occupations for each category, are provided in table 4.1.

Vocational Participation by Holland Categories

In table 4.2, respondents are classified by patterns of participation in vocational education within Holland's job categories. Seventy-five percent of the jobs held by all respondents are either realistic or conventional, with realistic accounting for 48 percent and conventional for 27 percent. But some

TABLE 4.1
DESCRIPTION OF HOLLAND'S OCCUPATIONAL TYPES

Occupational Environment	Sample Occupations
Realistic Fosters technical competencies and achievements, and manipulation of objects, machines, or animals; rewards the display of such values as money, power, and possessions. Encourages people to see the world in simple, tangible, and traditional terms.	Mechanical engineer Plumber Automechanic Fork lift operator
Investigative Fosters scientific competencies and achievements, and observation and systematic investigation of phenomena; rewards the display of scientific values. Encourages people to see the world in complex, abstract, independent, and original ways.	Physicist Weather observer Laboratory assistant
Artistic Fosters artistic competencies and achievements, and ambiguous, free, or unsystematized work; rewards display of artistic values. Encourages people to see the world in complex, independent, unconventional, and flexible ways.	Editor Decorator Garment designer Fashion model
Social Fosters interpersonal competencies, and informing, training, curing, or enlightening others; rewards the display of social or humanitarian values. Encourages people to see the world in flexible ways.	Minister Elementary teacher Physical therapist Ward attendant
Enterprising Fosters persuasive and leadership competencies or achievements, and the manipulation of others for personal or organizational goals; rewards the display of enterprising values and goals such as money, power, and status. Encourages people to see the world in terms of power, status, responsibility, and in stereotyped and simple terms.	Lawyer Contractor Automobile dealer Salesperson

TABLE 4.1
(Continued)

DESCRIPTION OF HOLLAND'S OCCUPATIONAL TYPES

Occupational Environment	Sample Occupations
Conventional	
Fosters conformity and clerical competencies, and explicit manipulation of data, records, or written material; rewards the display of such values as money, dependability, conformity. Encourages people to see the world in conventional, stereotyped, constricted, simple, and dependent ways.	Certified public accountant Secretary Timekeeper Clerk

SOURCE: Gottfredson, Linda S. "Construct Validity of Holland's Occupational typology in Terms of Prestige, Census, Department of Labor, and Other Classification System." *Journal of Applied Psychology* 65 (1980): 697-714. Reprinted by permission of the author and the American Psychological Association. Copyright 1980 by the American Psychological Association.

TABLE 4.2

HOLLAND OCCUPATIONAL CATEGORIES
BY PATTERNS OF VOCATIONAL PARTICIPATION
(PERCENTAGE DISTRIBUTION)

Holland Category	Patterns of Participation						
	Concentrator	Limited Concentrator	Concentrator/ Explorer	Explorer	Incidental/ Personal	Non-Vocational	Row Totals
Realistic	39.6	45.3	51.2	48.7	49.4	50.9	48.0
Investigative	4.8	3.1	2.3	0.0	5.5	7.0	4.9
Artistic	0.6	0.0	0.4	0.0	0.8	2.2	0.8
Social	8.7	9.9	9.8	17.9	12.7	11.7	11.2
Enterprising	7.9	7.4	6.3	1.8	7.3	11.1	8.0
Conventional	38.4	34.3	30.0	31.7	24.3	17.0	27.1
Column Totals	100.0	100.0	100.0	100.1	100.0	99.9	100.0
(Weighted N)	(248)	(403)	(221)	(31)	(767)	(420)	(2090)

NOTE: The numbers in parentheses represent the weighted distribution of cases in each column. Missing values have been excluded. Some columns do not total 100.0% because of rounding.

patterns are more likely than others to lead to realistic or conventional jobs.

If conventional and realistic jobs were combined into a single category, the four patterns with the greatest degree of involvement in vocational education would have relatively larger shares of their jobs falling into this single composite category, and this share would be remarkably similar for each of the four patterns, always falling between 78 and 81 percent. In contrast, only 74 percent of Incidental/Personal participants and 68 percent of people with no vocational credits held either conventional or realistic jobs. Thus, participation in vocational education with some concentration is significantly more likely to be associated with employment in realistic or conventional jobs than is incidental participation or no participation at all in vocational education.

When the shares of realistic and conventional jobs in these four patterns reflecting concentration are considered separately, they vary consistently with the degree of concentration represented by the profile. The share of realistic jobs is lowest for Concentrator, and it is lower for Limited Concentrator than for Concentrator/Explorer and Explorer. The share of conventional jobs is, conversely, highest for Concentrators and higher for Limited Concentrators than for the other patterns. The remarkable pattern in these results is that among these four patterns, as concentration increases, the increased share of conventional jobs is almost exactly offset by the decreased share of realistic jobs.

This pattern of increased representation in conventional jobs and decreased representation in realistic jobs as concentration increases implies a corresponding variation in the distribution of occupations among vocational specialties by concentration and Holland-type jobs. Table 4.3 shows the distribution of students by specialty area. Of the six specialty areas in which respondents received vocational training, trade and industry and office related areas accounted for 86 percent of the cases. A larger proportion of students who were trained in the trade and industry area were of the realistic type than for any other specialty except agriculture. Students who were trained for office jobs had relatively the fewest realistic and the most conventional jobs. But realistic jobs still accounted for a large fraction of all office specialists (37 percent). The relationship between concentration and the percentage of realistic and conventional jobs can now be explained: a shift in distribution of office specialists from predominantly realistic jobs to predominantly conventional jobs occurs as one considers patterns with greater concentration.

TABLE 4.3

SPECIALTY AREA BY HOLLAND OCCUPATIONAL CATEGORIES EMPLOYED RESPONDENTS WITH A SPECIALTY (PERCENTAGE DISTRIBUTION)

Holland Category	Vocational Specialty						
	Agriculture	Distributive Education	Health	Office	Trade & Industry	Home Economics	Row Totals
Realistic	75.1	58.9	39.7	37.1	71.9	48.8	46.9
Investigative	4.1	5.3	----	3.9	5.5	----	4.2
Artistic	----	----	----	0.4	0.7	----	0.4
Social	3.5	9.2	51.9	11.5	6.6	24.5	10.9
Enterprising	6.2	8.3	----	7.0	8.6	2.8	7.1
Conventional	11.1	18.4	8.4	40.1	6.8	23.9	30.6
Column Totals	100.0	100.1	100.0	100.0	100.1	100.0	100.1
(Weighted N)	(83)	(66)	(19)	(944)	(250)	(27)	(1389)

NOTE: The numbers in parentheses represent the weighted distribution of cases in each column. Missing values have been excluded. Some columns do not total 100.0% because of rounding.

Table 4.3 shows that the overwhelming majority of students who specialize in trade and industry held realistic jobs, where as office specialists were divided more evenly between realistic and conventional jobs. Table 4.4 shows that as one considers patterns with greater concentration, trade and industry specialists accounted for a relatively larger share of jobs within a pattern, and office specialists accounted for a relatively smaller share. Suppose realistic and conventional jobs held by office specialists were equally represented in each pattern. In that case, of the 57 percent of Concentrators who specialized in the office area, about 37 percent (17.1 percent of the total) would be found in realistic jobs and 40 percent (22.8 percent of the total) in conventional jobs. Similar distributions of office specialists would apply for other patterns. One would then anticipate that, since trade and industry jobs were relatively more important for Concentrators than for Limited Concentrators and Concentrator/Explorers, and since most trade and industry specialists held realistic jobs, realistic jobs should account for a relatively larger share of jobs among Concentrators than among Concentrator/Explorers. That anticipation is, of course, not borne out in the data in table 4.2.

It would appear, therefore, that whereas specialists in the office area were relatively evenly split in total between realistic and conventional jobs, office specialists who held conventional occupations were more likely to be Concentrators (in some degree) than were office specialists who held realistic occupations. And that tendency for greater concentration among conventional job holders who specialize in the office area must be strong enough to more than offset the increased share of Concentrators who specialize in the trade and industry area.

Although one can clearly say that most vocational education participants hold either conventional or realistic jobs, it does not strictly follow that vocational education trains people for predominantly conventional or realistic jobs. That conclusion would necessarily follow only if all participants with a specialty worked in training-related jobs. Table 4.5 shows, however, that only about 52.5 percent of employed participants who had a specialty were in training-related employment. And the distribution of employment among Holland categories is very different for those participants who were not in training-related employment than it is for those who were. Participants with a specialty who were not in training-related employment were much more likely to be in realistic, social, or enterprising jobs than were their counterparts in training-related employment. Determining what jobs vocational education trains people for is a problem because one cannot tell for certain for what jobs participants without training-related employment were trained. One knows, for example, that 59.8 percent of participants who were

TABLE 4.4

SPECIALTY AREA BY PATTERNS OF PARTICIPATION--EMPLOYED RESPONDENTS WITH A SPECIALTY (PERCENTAGE DISTRIBUTION)

Specialty Area	Patterns of Participation				
	Concentrator	Limited Concentrator	Concentrator/ Explorer	Incidental/ Personal	Row Totals
Agriculture	9.6	5.4	7.8	3.9	6.0
Distributive Education	1.0	8.5	5.0	3.5	4.2
Health	1.2	1.4	3.4	0.5	1.4
Office	57.0	57.2	64.6	82.9	68.6
Trade and Industry	29.7	24.1	16.2	8.5	17.9
Home Economics	1.5	3.3	3.0	0.7	2.0
Column Totals	100.0	99.9	100.0	100.0	100.1
(Weighted N)	(250)	(403)	(222)	(514)	(1389)

NOTE: The numbers in parentheses represent the weighted distribution of cases in each column. Missing values have been excluded.

not in training-related employment were not trained for realistic jobs. But one does not know for which types of jobs those participants were trained.

About 86 percent of the participants who found training-related employment were trained for realistic or conventional jobs. It would seem to be safe to conclude that most jobs for which vocational education participants were trained were either realistic or conventional.

It is nonetheless instructive to ask how sensitive to different assumptions about training is that estimate of the fraction of training devoted to conventional or realistic jobs. One alternative assumption gives the distribution labelled in table 4.5 as "Hypothetical Distribution #1." It is constructed by redistributing among the Holland categories the respondents with a specialty who were employed in unrelated occupations . It assumes that participants with a specialty who were not in training-related employment were trained for jobs in the same proportions as were participants who found training-related jobs. It includes all respondents with a specialty, but it differs from the distribution for respondents with training-related employment because respondents in unrelated occupations in any one Holland category could only have been trained for jobs in one of the other five categories. For example, respondents who held realistic jobs that were unrelated to their training could not have been trained for a realistic job and were reallocated to one of the other five categories in proportion to the relative distribution of participants who held training-related jobs in those five categories.

A second alternative assumption is that training occurred for jobs in Holland categories in proportion to the distribution of employment for respondents without a specialty. Under this assumption only respondents with a specialty were included, but those who were in unrelated jobs were reallocated, yielding the column labelled "Hypothetical Distribution #2."

The principal difference between the hypothetical distributions is in the fraction of respondents reallocated to the category of conventional jobs. Hypothetical Distribution #1 presents a likely upper bound of 56.9 percent for the fraction of training devoted to conventional jobs, where as Hypothetical Distribution #2 presents a likely lower bound of 41.7 percent. In either case it would seem that most jobs (probably between 70 and 85 percent) for which vocational education trains students are either conventional or realistic.

TABLE 4.5

HOLLAND OCCUPATIONAL CATEGORIES
BY
PLACEMENT OUTCOMES
(PERCENTAGE DISTRIBUTION)

Holland Category	Placement Outcomes					
	Respondents With a Specialty		Respondents Without A Specialty	All Respondents	Hypothetical Distributions of Jobs Trained For	
	In Related Occupations	In Unrelated Occupations			Assumption #1	Assumption #2
Realistic	35.3	59.8	50.0	48.0	26.9	29.6
Investigative	4.9	3.3	6.3	4.9	5.6	7.4
Artistic	0.3	0.5	1.8	0.8	0.3	1.5
Social	3.8	18.7	12.0	11.2	4.1	10.2
Enterprising	4.8	9.6	9.7	8.0	6.2	9.6
Conventional	50.9	8.1	20.3	27.1	56.9	41.7
Column Total	100.0	100.0	100.0	100.0	100.0	100.0
(Weighted N)	(721)	(653)	(692)	(2066)	(1374)	(1374)

NOTE: The numbers in parentheses represent the weighted distribution of cases in each column. Missing values have been excluded. The totals for respondents with a specialty differ from those in table 4.3 because placement classification required more information than did classification of specialty area, and not all respondents provided the additional information. Hypothetical distribution includes only those respondents who had a specialty. The assumption on which the reallocations are based is described in the text.

Training Level Requirements

The Holland job classification can be used to further characterize jobs obtained by vocational students. The three-digit census occupations included in each Holland class of job can be used to describe the Holland categories in terms of general education development (GED), specific vocational preparation (SVP), prestige, and earnings. These descriptions are based on data that apply to the census occupations, not on any information from the NLS New Youth Cohort.

GED refers to the education that contributes to a person's reasoning development and ability to follow instructions, and that provides knowledge such as language and mathematical skills. Generally, GED is obtained from elementary and secondary schools and colleges. An occupation can require levels of GED in each of three dimensions: verbal, mathematical, and reasoning skills. Separate GED scores for each dimension are based on a common six point scale as explained by table A-1 in Appendix A. To describe Holland-type jobs, a single GED level was selected for each three-digit census occupation by taking the highest of the three values assigned to that occupation in the Dictionary of Occupational Titles (U.S. Department of Labor 1977). These scores were used to compute the unweighted mean GED level for the occupations in each of the Holland areas. The GED levels for each occupation were converted to an equivalent number of actual years before averaging,* and these data for mean GED years are presented in table 4.6.

SVP refers to the amount of time required to learn the techniques, acquire information, and develop the facility needed for average performance in a specific job. SVP is obtained primarily through vocational education, apprenticeship, and on-the-job training. SVP levels are based on a nine-point scale. Table A-2 in Appendix A presents the scale, and the number of equivalent years for each level of SVP. Mean equivalent years of SVP were calculated for the occupations in each Holland job category, and the data are shown in table 4.6.

The required years of GED are highest for investigative jobs and lowest for realistic jobs. The required years of SVP were lowest for jobs of the conventional type, and highest for investigative and artistic jobs. Based only on the mean number of years of GED and SVP shown in these data, the conclusion can be drawn that the preparation needed for most of the jobs for which vocational education trains students can be accomplished

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*Conversion to years was based on Eckaus (1964).

TABLE 4.6

CHARACTERISTICS OF OCCUPATIONS IN HOLLAND CATEGORIES

Holland Category	Characteristics					
	Mean GED (Years)	Mean SVP (Years)	Mean Prestige (Siegel)	Median Earnings (Male)	Median Earnings (Female)	Number of Census Occupations
Realistic	10.1	1.7	33.2	$ 7,100	$4,100	198
Investigative	15.8	4.8	61.4	12,200	6,500	54
Artistic	14.7	4.4	51.9	9,500	5,000	12
Social	14.3	3.4	50.7	7,900	4,900	64
Enterprising	13.1	2.8	45.2	9,800	5,100	36
Conventional	11.0	1.2	41.2	6,600	4,300	37
All Occupations	12.1	2.6	42.3	7,700	4,600	406

SOURCES: Earnings data from U. S. Department of Commerce (1973). Education data from U. S. Department of Labor (1977). Prestige index from Siegel (1971).

NOTE: Median earnings figures for each sex omit those (43) occupations for which the Commerce Department had insufficient observations to publish estimates for that sex category. Most such omissions were for women in realistic occupations (22).

within the present kindergarden through twelfth grade public education system if the necessary SVP is included in the high school program. On the other hand the jobs in Holland categories other than realistic and conventional require higher levels of GED, which are generally obtained in postsecondary education.

Prestige and Earnings

Several highly correlated scales of occupational prestige (Duncan 1961; Temme 1975; Trieman 1977) have been used in research on occupational attainment. Prestige scales are based upon ratings by the general public of the desirability of occupations. The scale used for table 4.6 was developed by Siegel (1971), and is based upon ratings of 412 distinct occupational titles obtained from several traditional samples of the population.

The scale ranges from 0-100. Prestige categories were used, and their corresponding scores are as follows: poor (0-20), below average (21-40), average (41-60), good (61-80), and excellent (81-100). According to Siegel, the scale is interval, and the precision of measurement implies that differences between scores of up to five points are not interpretable. The prestige measures are therefore not very reliable for differentiating occupations that are close together in their social standing. Rather, the variable "prestige" characterizes relations between occupations. As before, an unweighted mean prestige score was computed for the occupations in each Holland job category and is shown in table 4.6.

Mean prestige score was highest for investigative jobs, which may be said to be "good" based on the scale presented previously. Artistic and social jobs have mean score values that are equal and place them in the "average" prestige category. Realistic jobs receive the lowest mean prestige score. This finding is consistent with the work of Gottfredson (1980) who used Temme's (1975) scale of occupational prestige to classify the 437 census occupational titles of 1970. She collapsed the two lowest levels of Temme's scale into one when she found that the majority of occupations on both levels were of the realistic type. The majority of the jobs for which vocational education prepares students are, therefore, of the lowest prestige based upon Siegel's system of reporting job prestige.

Table 4.6 shows to the nearest $100 the unweighted median earnings for occupations in each Holland job category. Earnings for males were substantially higher than they were for females. Investigative, enterprising, and artistic jobs had the highest earnings in that order. Few of the jobs for which vocational education trains students were among the most highly paid. For both sexes, median earnings are lowest for realistic and conventional jobs and predominantly these are the jobs for which vocational students are trained.

Traditionally, females dominate the conventional jobs for which vocational education prepares students, whereas males dominate the realistic jobs. Realistic jobs have higher earnings for males, and conventional have higher earnings for females. It is reasonable to expect that females in conventional jobs have pursued a higher level of concentration in vocational education than have females in realistic jobs, and thus were better prepared for work. This could explain why earnings for females are higher in conventional than in realistic jobs.

Labor Force Status and Training-related Placement

In addition to the foregoing description of the labor market segment into which the vocational education graduates move, three additional aspects of labor market participation were explored. For the total sample, the relative contribution of categories of participation in vocational education to the categories of employment, unemployment, and nonparticipation in the labor force was examined. In addition to this analysis, employment was broken into two categories, training related and non-training related, for those graduates who had an identified speciality. Finally, the effects of two specialities were examined in relation to the three labor market categories of employment, unemployment, and nonparticipation in the labor market.

Table 4.7 contains the percentage of each category of vocational participation in several categories of labor market status. The data suggest that when one has developed some level of concentration in a vocational specialty, there is a somewhat greater likelihood of being in the labor force, there is a slightly lesser likelihood of being unemployed, there is a lesser likelihood of being out of the labor force, and a substantially greater likelihood of being in a training-related job. There are, however, many other possible impacts on these groupings that are not reflected in table 4.7. The effects of sex, race, socioeconomic status, and different specialties all may have modified in significant ways the outcomes reflected in the percentages in the table.

The method used to allow those effects to be considered, in terms of labor market categories both individually and in combination with each other, was a log-linear analysis of the multiway table. As noted in chapter three, this method permits an assessment of the independent effects of each variable and also provides a test of significance of the effects' contribution to each cell. To express the effects in commonly recognizable terms, the

TABLE 4.7

LABOR FORCE STATUS AND VOCATIONAL PARTICIPATION— HIGH SCHOOL GRADUATES (PERCENTAGES)

Labor Force Status	Patterns of Participation						
	Concentrator	Limited Concentrator	Concentrator/ Explorer	Explorer	Incidental/ Personal	No Vocational Credits	Row Total
Labor Force Participation Rate	83.9	82.9	81.9	86.2	75.7	68.5	77.0
Unemployment Rate (as a percentage of the labor force)	9.7	9.5	8.9	12.0	11.8	11.7	10.8
Percentage of Respondents Out of the Labor Force	16.2	17.1	18.2	13.8	24.3	31.5	23.0
Percentage of Respondents in Training-related Jobs	52.9	44.4	40.3	–	19.1	–	25.0
(Weighted N)	(330)	(553)	(312)	(43)	(1145)	(672)	(3054)

NOTE: The percentages in this table are not additive by columns, because the labor market categories are not mutually exclusive.

multiplicative parameters were converted to percentages, as described in chapter three. It is essential to note the difference between the pecentages derived for this purpose (in tables 4.8 through 4.10) and those in table 4.7. The latter percentages reflect the proportion of respondents in each vocational education participation category who are also in each labor market category. The percentages representing the effects of the explanatory variables, such as race, reflect instead the amount that the expectancy for membership in any cell involving race is altered from what it would be if race had no effect. A percentage in table 4.7 simply shows the distribution of cases among categories. A percentage in tables 4.8 through 4.10 shows a change in the distribution attributable to an explanatory variable (such as race). For each percentage in a column of table 4.7 the base is either the number of cases actually in that column or, for the unemployment rate, the number who are in the labor force. For each percentage in a cell of tables 4.8 through 4.10, the base is the number of cases that one would expect to fall in that cell if the effect represented by the cell were absent.

The influence of race and sex were allowed for in all of the analyses, and categories for high and low socioeconomic status were included in the first two. A separate analysis deals with the two most popular specialties.

Briefly, the process of analysis requires first that a model be found which generates expected frequencies for each cell of the multiway table containing the observed frequencies such that the residuals are nonsignificant. Following the argument developed by Brown (1976), both the partial and marginal tests of significance are considered in arriving at a conclusion about the adequacy of the model.

The categories that are treated in this analysis as explanatory are fixed prior to the determination of membership in the labor market categories. Although this fact does not establish causality, it does determine the direction of the effect, and therefore is consistent with a consequential interpretation.

A further point regarding the categories warrants explanation. The number of categories within some factors has been reduced where the presence of zero frequencies suggests a problem or where the type of analysis required a redefinition. Specifically, the six categories of vocational participation, ranging from maximum concentration to no participation, were reduced to four when all graduates in the sample, or those in the subsample of office and trade and industry specialists, were considered. The categories were reduced to three when graduates with all identified specialties were considered. These regroupings were logical rather than arbitrary because they represent compression of an ordered set of categories that theoretically have an underlying continuum. Also, the race variable, for which blacks, Hispanics, and whites could be identified, was regrouped into whites and minorities, because Hispanics were unrepresented in many cells and the labor market effects were expected to be similar for most minority groups.

Labor Force Status of High School Graduates

Table 4.8 presents the data for the total group, with labor market categories considered as the dependent variables. The model that adequately represents the distribution of the observations across the categories of classification includes the main effects for labor market (L), vocational education patterns (P), race (R), sex (S), and family socioeconomic status (F). It also includes the first order interactions of patterns, race, sex, and SES with the labor market (PL, RL, SL, FL respectively), and second order interactions FSL, FRL, and SPL.

The term interaction is interpreted somewhat differently for log-linear analysis than for the more commonly used analysis of variance. In this context it means that there is an increment or decrement to the expectancies in the cells of a variable of interest due to the effect of an explanatory variable. The second order effects reflect the fact that there are additional and independent increments and decrements in the expectancies for a variable of interest due to the combined effect of two explanatory variables on the variable of interest. This intrepretation should become clearer upon examination of the actual results. The model is hierarchical, and therefore includes all interactions that are nested in the second order interactions (that is, FS, FR, SP). However, only those that involve the labor market are presented and discussed.

The largest single effect in this table is minority status. Being black or Hispanic reduces the expectancy of being in the employed category by nearly 28 percent. It is also apparent that the category into which these minority respondents fall is unemployment rather than being out of the labor force. The magnitude of the minority effect on unemployment is 27 percent. The minority effect on being out of the labor force is a nonsignificant value. The effects of being white are opposite and of similar, although slightly less, magnitude.

The next effect in order of magnitude is sex, although at first glance this might not appear to be true, because there are larger values in the ELSE category (Incidental/Personal participants, Explorers, nonparticipants in vocational education). However, there are four categories of vocational participation and only two of sex. This means that only one-fourth of the cells in

TABLE 4.8

EFFECTS ON LABOR FORCE STATUS-- HIGH SCHOOL GRADUATES (PERCENTAGES)

LOG-LINEAR MODEL: FP, FSL, FRL, SPL

EFFECTS INTERACTIONS	LABOR FORCE STATUS											
	EMPLOYED				UNEMPLOYED				OUT OF LABOR FORCE			
	Concentrator	Limited Concentrator	Concentrator Explorer	Else	Concentrator	Limited Concentrator	Concentrator Explorer	Else	Concentrator	Limited Concentrator	Concentrator Explorer	Else
PL	7.2%	12.2%	4.5%	-20.5%*	-0.3%	-4.6%	5.3%	-0.2%	-6.5%	-6.5%	-9.2%	20.0%*
	White		Minority		White		Minority		White		Minority	
RL	21.5%		-27.7%		-21.3%*		27.1%*		-4.4%		4.6%	
	Male		Female		Male		Female		Male		Female	
SL	13.8%*		-12.1%*		6.0%		-5.7%		-17.2%*		20.7%*	
	Lo		Hi		Lo		Hi		Lo		Hi	
FL	2.5%		-2.5%		14.4%		-12.6%		-14.7%		17.3%*	
	Male Lo	Male Hi	Female Lo	Female Hi	Male Lo	Male Hi	Female Lo	Female Hi	Male Lo	Male Hi	Female Lo	Female Hi
FSL	4.9%	-4.6%	-4.6%	4.9%	7.9%	-7.3%	-7.3%	7.9%	-11.6%	13.1%*	13.1%*	-11.6%
	White Lo	White Hi	Minority Lo	Minority Hi	White Lo	White Hi	Minority Lo	Minority Hi	White Lo	White Hi	Minority Lo	Minority Hi
FRL	-3.7%	3.8%	3.8%	-3.7%	16.1%*	-13.8%*	-13.8%*	16.1%*	-10.6%*	11.8%*	11.8%*	-10.6%*

*Significant at .05 level

Model fit:	Degrees of Freedom	57
	Likelihood Ratio Chi sq.	54.11
	Probability	.584
	Pearson Chi sq.	51.98
	Probability	.663

Interactions

PL - Pattern by Labor Force Status
RL - Race by Labor Force Status
SL - Sex by Labor Force Status
FL - Family SES by Labor Force Status
FSL - SES by Sex by Labor Force Status
FRL - SES by Race by Labor Force Status
SPL - Sex by Pattern by Labor Force Status
FP - SES by Pattern

any labor market status category will be affected by any single vocational participation category, whereas half of the cells will be affected by either sex category, thereby doubling the possible effect of gender. Being female reduces the expectation of being employed by 12 percent and increases the expectation of being out of the labor force by 21 percent. Again, corresponding values of similar magnitude and opposite sign demonstrate the effect of being male. Note that the effect of gender differs from the effect of race not only in magnitude but in the labor market category in which the effect is felt. There are no significant effects of being female on unemployment, but being female reduces the expectancy of employment and increases the expectancy of being out of the labor force.

Next in order of magnitude are the effects of family SES. Significant effects are confined to the category of being out of the labor force. Being high SES has a strong positive effect, 17 percent, on this category, and being low SES has a strong but opposite effect. The effects on unemployment, although not significant (z-ratios = 1.65 for low and -1.65 for high SES), are probably important. They are called to the reader's attention because the z-tests are conservative. Two artifacts of the analysis bring this about. One is the fact that certain cells contain no observations, although there is no logical reason why they would be empty if the sample were large enough. There are, for example, no high SES minority males who are vocational education Concentrators who are out of the labor force. Second, obtaining significance tests for the parameters requires a direct model, which in this case uses two nonsignificant interactions that are not used in the fitted model. The result is a lower bound estimate of significance. The effects values of SES on unemployment are 14 percent for low SES and negative 13 percent for high SES.

Although the next order of effect magnitude is found in the vocational participation category, for interpretive purposes the second order interactions are considered next. Family SES and sex, taken together, have a significant effect on being out of the labor force. Low SES males and high SES females are less likely to be out of the labor force, whereas high SES males and low SES females are more likely to be out of the labor force. Although the data analyzed do not suggest reasons for this phenomenon, possible explanations are in the tendency of high SES males in this age group (seventeen to twenty-three) to be in school and low SES females may be kept at home by family responsibilities. The magnitudes of the effects are 12 percent for the reduced expectations and 13 percent for the increased expectations.

Family SES and race, taken together, have a significant impact on the labor market categories of unemployment and out of the labor force. Low SES whites and high SES minorities are less likely to be out of the labor force and more likely to be unemployed. The opposite effects apply for high SES whites and low SES minority, both of whom have lesser expectancies of being unemployed but greater expectancies of being out of the labor force.

The vocational participation/labor market interactions were few. There is a significant negative effect on being employed if one is a nonvocational participator, an Incidental/Personal participator, or an Explorer. These groups are represented by the category ELSE. There is a significant positive effect on being out of the labor force for this category of participation. Although none of the remaining effects are individually significant, for those individuals who have sufficient participation in vocational education to be classified as Concentrator/Explorers or higher, the expectancies for being employed are consistently higher and those for being out of the labor force are lower. This consistent trend is not likely to be a chance occurrence. For all high school graduates in this panel of NLS Youth, the demonstrated net effect is that whereas trends are in the expected positive directions for vocationally trained graduates, vocational training is not a powerful enough effect to offset the combined disadvantages of minority status and low SES. Because the classification used in this analysis rests on an assumption that the skill accumulation varies uniformly with the patterns of participation, it is possible that a model containing a program quality variable might have provided a more definite result. Data for such a variable, however, were not available for the NLS Youth.

Training-Related Placement

When the subsample of graduates who have been involved enough in vocational education to develop a specialty are considered, the subject of training related placement may also be treated. Estimates of the effects emerge as presented in table 4.9. The model that significantly and adequately represents the data for this subsample includes the family SES, minority, and labor market interaction (FRL), the family SES, sex, and labor market interaction (FSL), family SES and vocational education interaction (FP), and the vocational education and labor market interaction (PL). All lower order interactions and main effects that are nested in these are also included. Note that it was unnecessary to include a minority, vocational education, labor market interaction to account for these data.

As in the previous sample, this discussion considered first the effects outside of vocational education. The strongest effect in this subsample is also the RL interaction, with

TABLE 4.9

EFFECTS ON LABOR FORCE STATUS AND PLACEMENTS-- GRADUATES WITH A SPECIALTY
(PERCENTAGES)
LOG-LINEAR MODEL: PL, FP, FSL, FRL

EFFECTS INTERACTIONS	LABOR FORCE STATUS															
	IN TRAINING RELATED EMPLOYMENT				IN UNRELATED EMPLOYMENT				UNEMPLOYED				OUT OF LABOR FORCE			
	Concen- trator	Limited Concen- trator	Concentrator Explorer and Incidental Personal		Concen- trator	Limited Concen- trator	Concentrator Explorer and Incidental Personal		Concen- trator	Limited Concen- trator	Concentrator Explorer and Incidental Personal		Concen- trator	Limited Concen- trator	Concentrator Explorer and Incidental Personal	
PL	28.2%*	5.9%	-26.4%*		-19.9%*	4.7%	19.3%*		3.5%	-3.3%	0.0%		-5.9%	-6.7%	13.9%*	
	White		Minority		White		Minority		White		Minority		White		Minority	
RL	12.9%*		-11.4%*		23.0%*		-18.7%*		-28.4%*		39.7%*		0.6%		-0.6%	
	Male		Female		Male		Female		Male		Female		Male		Female	
SL	0.4%		-0.4%		19.8%*		-16.5%*		5.8%		-5.5%		-21.4%		27.3%*	
	Lo		Hi		Lo		Hi		Lo		Hi		Lo		Hi	
FL	7.4%		-6.9%		-4.4%		1.4%		13.8%		-12.2%		-19.1%*		20.6%*	
	Male Lo	Male Hi	Female Lo	Female Hi	Male Lo	Male Hi	Female Lo	Female Hi	Male Lo	Male Hi	Female Lo	Female Hi	Male Lo	Male Hi	Female Lo	Female Hi
FSL	11.7%	-10.4%	-10.4%*	11.7%*	2.9%	-2.9%	-2.9%	2.9%	0.1%	-0.1%	-0.1%	0.1%	-13.1%*	15.1%*	15.1%*	-13.1%*
	White Lo	White Hi	Minority Lo	Minority Hi	White Lo	White Hi	Minority Lo	Minority Hi	White Lo	White Hi	Minority Lo	Minority Hi	White Lo	White Hi	Minority Lo	Minority Hi
FRL	-7.0%	7.5%	7.5%	-7.0%	-2.0%	0.2%	0.2%	-0.2%	22.2%*	-18.1%*	-18.1%*	22.1%*	-11.8%*	13.4%*	13.4%*	-11.8%*

*Significant at .05 level

Model fit:	Degrees of Freedom	62
	Likelihood Ratio Chi sq.	57.24
	Probability	.647
	Pearson chi sq.	55.91
	Probability	.693

Interactions

PL - Patterns by Labor Force Status
RL - Race by Labor Force Status
SL - Sex by Labor Force Status
FL - Family SES by Labor Force Status
FSL - SES by Sex by Labor Force Status
FRL - SES by Race by Labor Force Status
FP - SES by Pattern

minority status being significantly associated with high unemployment. Minorities appear less likely to be in unrelated employment than in training-related employment, although in both cases they are at a disadvantage compared to whites.

Next in order of relative magnitude is the SL interaction. Being female increases the likelihood of being out of the labor force and moderately decreases the likelihood of being in employment unrelated to training.

Family SES appears to exert its effect primarily on the labor market category of being out of the labor force. Low SES has a negative effect on this category with the opposite effect for high SES. All other effects are nonsignificant, although unemployment shows a low SES/higher unemployment-high SES/lower unemployment pattern that approaches significance.

The second order interactions have several small but significant effects. Low SES whites are more likely to be in the labor force but are also more likely to be unemployed. High SES minorities demonstrate the same pattern. Although no obvious explanation accounts for this phenomenon, a check of the actual cases in the sample confirmed that the pattern accurately represents the actual data. The opposite situation is true for high SES whites and low SES minorities, who are not only more likely to be represented in the out-of-the-labor-force group but also are less likely to be unemployed.

The sex/SES interaction with the labor force has significant effects in the out-of-the-labor-force and training-related employment categories, paralleling the findings for the total group with respect to participation in the labor force, but showing the significant effect of that participation on training-related employment. Low SES males tend to be in the labor force and in training-related employment. High SES males tend to be out of the labor force and have a lower likelihood of being in training-related employment. Those who are out of the labor force may well be in postsecondary education, which may produce migration away from training-related employment toward higher prestige and higher paying jobs. Females, on the other hand, tend to be out of the labor force if they are low SES and are less likely to be represented in training-related employment. High SES females are more likely to be in training-related employment and have lower expectations of being out of the labor force.

The effects of vocational education, the PL interaction, are more striking in this sample than among the total group. The Incidental/Personal and Concentrator/Explorer participators have a positive expectation of being out of the labor force. If they are working they have greater likelihood of being in unrelated employment and substantially lower expectations of being in training-related employment. The effect on unemployment is neutral. Concentrators, on the other hand, have a strong likelihood of being in training-related employment and a relatively strong negative expectation of being in unrelated employment. The fact that no race or SES interactions with vocational participation were necessary to account for the distribution of cases in this sample is an argument in favor of the hypothesis that vocational concentration can in part overcome the negative effect on training-related employment produced by minority status.

Specialties and Labor Force Status

The third categorical analysis carried out considered the sample of high school graduates who had developed a specialty in either office or trade and industry. No other specialties were considered in the sample. The data are presented in table 4.10. The variables in this table are those used in the previous two tables with the omission of family SES (F) and the addition of the specialties, coded C in the interactions and identified in the body of the table as O for office and business and TI for trade and industry. Small cell frequencies prevented distinguishing between training-related and unrelated employment.

The model that adequately fits these data includes the first order interactions of race and labor force (RL), race and specialty (RC), and vocational pattern and labor force (PL). The required second order interactions are sex, specialty, and vocational pattern (SPC), and sex, labor force, and pattern (SCL). Because the model is hierarchical, it also includes all lower order effects nested within those listed. Interpretation addresses only those interactions that involve the labor force, because they are the effects of interest in this study. In this sample, as in the two previous samples that included this one, minority status has a large and significant negative effect on employment and a corresponding opposite effect on unemployment. The pattern in these two categories is, of course, opposite for those classified as white and other. The complete absence of an effect relating to nonparticipation should be noted. Note also that there is no interaction involving race and sex required to fit the data.

The largest single effect in this subsample is found for females who are out of the labor force. Males are more likely to be employed than females, but in both cases the effects apply to employment and being out of the labor force rather than to being unemployed. This seeming anomaly is further explained by the interaction of sex and specialty with the labor force categories. The specialties alone have the greatest impact on being out of

TABLE 4.10

EFFECTS ON LABOR FORCE STATUS-- GRADUATES IN OFFICE OR TRADE AND INDUSTRY (PERCENTAGES) LOG-LINEAR MODEL: RL, RC, PL, SPC, SCL

EFFECTS INTERACTIONS	LABOR FORCE STATUS											
	EMPLOYED				UNEMPLOYED				OUT OF LABOR FORCE			
	Concentrator	Limited Concentrator	Concentrator Explorer	Else	Concentrator	Limited Concentrator	Concentrator Explorer	Else	Concentrator	Limited Concentrator	Concentrator Explorer	Else
PL	5.6%	6.1%	0.1%	-10.9%	1.2%	-3.9%	6.8%	3.8%	-6.4%	-2.0%	-6.5%	16.6%
	White		Minority		White		Minority		White		Minority	
RL	23.2%		-18.8%		-19.5%		24.2%		-0.8%		0.8%	
	Male		Female		Male		Female		Male		Female	
SL	21.3%*		-17.6%*		4.2%		-4.0%		-20.9%*		26.3%*	
	Office		Trade & Industry (TI)		Office		Trade & Industry (TI)		Office		Trade & Industry (TI)	
CL	-0.3%		0.3%		-17.8%		21.7%		22.1%*		-18.1%*	
	Male Office	Male TI	Female Office	Female TI	Male Office	Male TI	Female Office	Female TI	Male Office	Male TI	Female Office	Female TI
SCL	-14.6%*	17.1%*	17.1%*	-14.6%*	-3.3%	3.4%	3.4%	-3.3%	21.2%*	-17.5%*	-17.5%*	21.2%*

*Significant at .05 level

Model fit:		
	Degrees of Freedom	62
	Likelihood Ratio Chi sq.	51.98
	Probability	.814
	Pearson Chi sq.	53.45
	Probability	.772

Interactions

PL - Patterns by Labor Force Status
RL - Race by Labor Force Status
SL - Sex by Labor Force Status
CL - Specialty by Labor Force Status
SCL - Sex by Specialty by Labor Force Status
SPC - Sex by Pattern by Specialty

the labor force. The office specialty has a significant and strong positive effect in the direction of nonparticipation in the labor force, whereas trade and industry trained graduates are more likely to be in the labor force. The unemployment category approaches significance but does not achieve the 5 percent level. Because the z-tests are conservative, this may be an important conclusion. It suggests that trade and industry trained graduates are more likely to be unemployed than office graduates. The interaction of sex and specialty with the labor market reveals some interesting but not unexpected trends. Males trained in office are more likely to be out of the labor market and less likely to be employed. The reverse is true for females. If trained in office they are more likely to be in the labor force and to actually have jobs. When the training is in trade and industry, the exact opposite is the pattern. Males have an increased expectancy of being in the labor force and having jobs; females have an added expectancy of being out of the labor force if they do not have jobs rather than of being unemployed. In no case does this interaction have a significant effect on unemployment.

The common sense explanation of these findings is that employers are traditionally unaccustomed to employing males in office positions of the kind for which secondary vocational education is appropriate training and that for those females with similar training, the job market for office type jobs is open. An alternative explanation is that substantial proportions of both male and female office-trained persons may be involved in postsecondary education. This analysis does not provide an evaluation of the explanatory adequacy of these alternatives.

The categorical analysis just presented illustrates in part the major influences upon job market participation that are outside the control of vocational education and points out the circumstances under which vocational education patterns of participation appear to have effects. The next section examines quantitatively the factors that determine the economic returns to the student from participation in vocational education.

Earnings

As figure 1 in chapter 1 illustrates, vocational education is only one of many influences on earnings. Assessing its effect requires controlling in some way for these other influences. For example, earnings can be thought of as being determined by individual and contextual attributes (such as sex, race, and region of residence), by local labor market conditions (such as labor demand), by individuals' work history (such as their work experience and tenure on their current job), and by characteristics of the current job itself (such as whether it is unionized or in specific industries). These influences are allowed for in the specification of an equation as either type (1) or type (1c) and in the interpretation of the equation, as discussed in chapter 3.

The earnings variable that is used here applies to the position that respondents regard as their principal employment at the time of the interview. As explained in chapter 2, that position was either the one held on the interview date or, if the respondent was not working at the time of the interview, the most recently held position (provided it was held within three months before the interview). This approach is more pertinent to the principal policy questions than is an approach such as that used by Conroy (1979), which considered total income from wages and salaries during some year. The central concern of policymakers is whether participation in vocational education confers advantages in earnings in the principal job that a person holds. Total wage and salary income can include earnings from several successive employment episodes in different jobs, from two or more jobs held concurrently, or from jobs in what has come to be called the "irregular economy." Whether vocational education participants are more likely to be multiple job holders or to have episodic employment histories is interesting, but these are distinct and subordinate issues. Using total wage and salary income fails to distinguish those subordinate issues from each other or from the earnings issue that is the principal focus of this section of the analysis.

Other studies that have also focused on the earnings associated with a respondent's principal job include Meyer and Wise (1979), Grasso and Shea (1979b)*, Gustman and Steinmeier (1981), and Meyer (1981). These studies used hourly, weekly, and/or annual earnings. Where weekly or annual earnings were used, additional equations were usually estimated for hours worked per week and weeks worked per year. This approach maintains the distinction among the relevant issues that the use of total wage and salary income blurs.

Direct and Total Effects

Table 4.11 describes the explanatory variables and their coefficient estimates as shown in tables 4.12 and 4.13. Tables 4.12 and 4.13 show the estimated OLS coefficients for two representative specifications of the earnings equation. Table 4.12

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*Grasso and Shea (1979b) used both hourly earnings on the principal job at the time of the interview and total wage and salary income in the year preceding the interview. In most cases they found no significant difference between vocational and general students for either measure of earnings.

TABLE 4.11

EXPLANATORY VARIABLES IN REGRESSIONS

Elements of X: SOUTH: = 1 if respondent currently resides in South

WEST: = 1 if respondent currently resides in West

RURAL: = 1 if respondent currently resides in rural area

UNEMP79: Local unemployment rate in 1979

CLSRNK: Class rank, expressed as a percentage with 100 high and 0 low

SESHI: = 1 if socioeconomic status of the respondent is exceptionally high

SESLO: = 1 if socioeconomic status of the respondent is exceptionally low

MARRIED: = 1 if respondent is married with spouse present

Elements of J: UNION: = 1 if wage on respondent's job is established through collective bargaining with a union

DURMFG: = 1 if respondent's job is in durable manufacturing

CONSR: = 1 if respondent's job is in construction

TENURE: Months working for current employer

WORKEX: Potential work experience of respondent

Elements of E: CONC: = 1 if respondent is a Concentrator

LCON: = 1 if respondent is a Limited/Concentrator

CONEX: = 1 if respondent is a Concentrator/Explorer

EXP: = 1 if respondent is an Explorer

IP: = 1 if respondent is classified as Incidental/Personal

HGC13,: HGC14, HGC16, = 1 if respondent's highest grade of formal education completed is, respectively, 1 year, 2 years, or 4 years beyond high school graduation

RELATE: = 1 if respondent's current job is related to high school vocational training

AG: = 1 if respondent's specialty in vocational education is agriculture

OFFICE: = 1 if respondent's specialty in vocational education is office

TI: = 1 if respondent's specialty in vocational education is trade and industry shows estimates of equation (1) whereas table 4.13 shows estimates of equation (1c). In both equations the results apply to weekly earnings expressed in dollars rather than in logarithms. The sample is restricted to include only those respondents who have completed exactly twelve years of education and who were not students at the time they were interviewed. That restriction is designed to make as "clean" a comparison as possible between vocationally and academically trained high school graduates who have a "full-time" participation in the labor market. No additional restriction on hours worked per week was imposed in selecting this subsample. A less restrictive comparison that includes currently enrolled respondents is also discussed below.

The tables show that the signs and magnitudes of estimates of the structural coefficients of the elements of X (individual and contextual attributes, local conditions, and work history) and J (job characteristics) generally conform to expectations. The constant terms in the equations suggest plausible differences in weekly earnings across race/sex classifications for the normalizing group of respondents. Equation (1) normalizes on persons living in an urban area outside the South or West, with average SES, working in a nonunion job outside construction or durable manufacturing, at the bottom of their high school class, with no vocational credits, and no work experience or job tenure. White males who fit this description are estimated to earn an average of about fifty-one dollars per week more than minority men and about a hundred dollars per week more than women. As one accumulates work experience and tenure on the job, earnings tend to rise slowly. Jobs in durable manufacturing, construction, or unionized firms are associated with substantially higher weekly earnings. Current labor market conditions depress earnings somewhat, though significantly only for white men. This result reflects the dominance of white men in jobs whose hours vary over the business cycle. When educational attainment is restricted to exactly twelve years, class rank and socioeconomic status of parents do not contribute significantly (except for minority women) to explaining earnings differences. But seven of eight coefficients on SES have signs in the expected direction. Living in the West has a marked positive effect on the earnings of whites, whereas living in rural areas depresses their earnings. Minority workers in urban areas may earn less than their counterparts in rural areas, although the differences are not statistically significant. Finally, residing in the South, per se, apparently no longer has the depressing effect on earnings that one would have found ten years ago.

TABLE 4.12

DIRECT EFFECTS ON USUAL WEEKLY EARNINGS
(DOLLARS PER WEEK)
NOT ENROLLED, EXACTLY TWELVE YEARS OF EDUCATION
(EQUATION 1) OLS

Explanatory Variable	White Male	Minority Male	White Female	Minority Female
CONC	-11.12	-27.78	18.77	40.19*
	(.6)	(.8)	(1.4)	(1.8)
LCON	-12.10	-12.08	10.88	-1.52
	(.7)	(.4)	(.9)	(.1)
CONEX	2.51	22.44	9.34	-8.19
	(.1)	(.6)	(.7)	(.4)
EXP^{+}	24.29	-64.02	15.73	45.12
	(.6)	(.8)	(.5)	(1.2)
IP	-1.98	-7.13	6.19	8.32
	(.8)	(.2)	(.5)	(.5)
SOUTH	10.48	-7.23	-3.91	.30
	(.7)	(.3)	(.4)	(.0)
WEST	48.79**	-4.47	19.77**	7.09
	(2.6)	(.2)	(2.1)	(.5)
RURAL	-10.11	39.48	-13.44*	16.18
	(.7)	(1.2)	(1.7)	(.7)
SESHI	7.92	31.98	12.01	37.13
	(.3)	(.4)	(.9)	(1.3)
SESLO	-29.43	9.56	-11.90	-20.47*
	(1.5)	(.4)	(1.2)	(1.9)
UNEMP79	-6.95**	-2.46	-.85	-.15
	(2.6)	(.4)	(.5)	(.1)
UNION	85.53**	31.00	24.86**	16.53
	(6.4)	(1.4)	(3.0)	(1.2)
CLSRNK	-.16	-.10	-.06	-.14
	(.7)	(.2)	(.5)	(.7)
DURMFG	31.36**	50.04**	41.63**	85.08**
	(2.2)	(2.2)	(3.9)	(4.3)

TABLE 4.12 (Continued)

Explanatory Variable	White Male	Minority Male	White Female	Minority Female
CONSTR	73.00** (4.1)	-19.04 (.4)	66.02** (3.3)	-
WORKEX	.70* (1.9)	1.55** (2.1)	.19 (.9)	.42 (1.2)
TENURE	.57* (1.7)	-.29 (.5)	.60** (2.6)	.53 (1.3)
MARRIED	-	-	-1.48 (.2)	-1.69 (.1)
CONSTANT	214.85** (7.4)	163.18** (3.2)	117.21** (6.6)	120.16** (4.1)
N	293	107	305	116
R^2	.28	.21	.19	.34
Adj. R^2	.23	.06	.14	.23
F	6.26	1.39	3.71	3.03

t-values in parentheses
* Significant at .10 level
** Significant at .05 level
+ Estimates for explorers are based on only 2 to 6 observations and should be interpreted cautiously

Except for minority men, these estimates of equation (1) account for a statistically significant percentage of variation in earnings, as shown by the F-statistic. The (unadjusted) percentages of variation explained range from 19 percent to 34 percent. Overall, the sample permits a plausible explanation of a large fraction of variation in earnings within the race/sex classifications. One would expect, also, that estimates of the effects of education on earnings should be plausible.

Recall that the coefficients estimated in table 4.12 represent the direct effects of high school vocational education on weekly earnings. Only one of the estimated direct effects is statistically significant at the .10 level. But an interesting pattern does emerge for those people with the greatest concentration in vocational education (Concentrators and Limited Concentrators). In terms of direct effects, concentration and limited concentration tend to be weakly associated with lower weekly earnings for men and somewhat more strongly associated with higher weekly earnings for women (significantly higher for minority women Concentrators).

When the total effects are considered in table 4.13 (the sum of direct effects and of the indirect effects operating through J), the pattern is drawn more vividly. Male Concentrators and Limited Concentrators are weakly associated with lower weekly earnings; females with any vocational credits are more strongly associated with higher weekly earnings. Female Concentrators earn significantly more per week than women with no vocational courses.

These estimates are broadly consistent with the finding of Grasso and Shea (1979b) that, among people with exactly twelve years of education, women who took business or commercial courses report significantly positive total effects on earnings compared to those who did not take such courses, whereas men who took vocational courses report insignificantly lower earnings. As noted below, most women Concentrators were classified as specialists in the business (office) area. Hence, the estimated coefficient for women Concentrators is, in effect, an estimate of the impact of office training. Grasso and Shea used hourly rather than weekly earnings, however. The estimates in tables 4.12 and 4.13 reflect a combined impact on hourly earnings and hours worked per week. Estimates for the New Youth Cohort using hourly earnings are discussed below and do not reproduce the significant positive estimates of Grasso and Shea, which were derived using the (Parnes) NLS Young Men and Young Women's samples.

The positive estimates for women are also broadly consistent with estimates of total effects made by Gustman and Steinmeier (1981), from the Parnes data for young women and from data for women in the Class of 1972 survey. Gustman and Steinmeier reported a more highly significant coefficient for white females

TABLE 4.13

TOTAL EFFECTS ON USUAL WEEKLY EARNINGS
(DOLLARS PER WEEK)
NOT ENROLLED, EXACTLY TWELVE YEARS OF EDUCATION
(EQUATION 1c) OLS

Explanatory Variable	White Male	Minority Male	White Female	Minority Female
CONC	-15.16 (.7)	-25.39 (.8)	25.98** (1.9)	58.54** (2.7)
LCONC	-12.09 (.6)	-17.70 (.6)	13.32 (1.0)	7.24 (.4)
CONEX	12.55 (.4)	13.50 (.4)	15.39 (1.1)	5.89 (.3)
EXP$^+$	21.60 (.5)	-74.55 (1.2)	22.22 (.7)	48.80 (1.3)
IP	-3.06 (.2)	-4.10 (.1)	9.15 (.7)	10.26 (.6)
SOUTH	-4.84 (.3)	-32.53 (1.5)	-8.87 (1.0)	.21 (.0)
WEST	19.16 (.9)	-16.49 (.6)	11.24 (1.2)	-2.76 (.2)
RURAL	-17.4) (1.1)	38.60 (1.3)	-13.52* (1.7)	14.37 (.6)
SESHI	-6.14 (.2)	20.12 (.3)	9.13 (.7)	34.43 (1.1)
SESLO	-16.90 (.8)	4.85 (.2)	-14.41 (1.5)	-13.87 (1.3)
CLSRNK	-3.98 (.1)	.11 (.3)	-.11 (.9)	-.06 (.3)
WORKEX	1.24** (3.1)	1.49** (2.4)	.42** (2.0)	.81** (2.6)
MARRIED	-	-	.40 (.1)	-.62 (.0)

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TABLE 4.13 (Continued)

Explanatory Variable	White Male	Minority Male	White Female	Minority Female
CONSTANT	206.30** (7.9)	174.40** (4.0)	123.72** (8.1)	112.51** (4.7)
N	302	117	336	131
R^2	.06	.13	.06	.17
Adj. R^2	.02	.03	.03	.08
F	1.44	1.29	1.71	1.86

t-values in parentheses
* Significant at .10 level
** Significant at .05 level
+ Estimates for explorers are based on only 2 to 6 observations and should be interpreted cautiously

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and a less significant coefficient for black females in office courses than is found here for Concentrators. For males there was a greater, but not decisive, difference in estimates. Gustman and Steinmeier reported negative estimates for black males and positive estimates for white males. But in neither case were the estimates significantly different from zero.

Earnings Effects of Training-Related Placement

The general thrust of these findings is not altered when indicators of training-related placement and area of vocational specialization are added separately to a weekly earnings equation of the form of (1c). Estimated coefficients (for the education variables only) are presented in Tables 4.14 and 4.15.

Because of the relatively high rate of training-related placement among all three classes of Concentrators, and because one must have a specialty to obtain a training-related placement, the variable RELATE was highly correlated with CONC, LCON, and CONEX, as well as with the variables that identify specialty areas. Hence, RELATE and the specialty variables were not included in the same equation.

Introduction of RELATE alone added little to the equation's overall explanatory power, but it reduced the estimated coefficients on the vocational pattern variables, reducing their apparent significance for all profiles for all race/sex classes. On the other hand, the estimated coefficient was positive for all race/sex classes, indicating at least a consistent (if not statistically significant) tendency for training-related placement to be associated with higher earnings.

When indicators of specialty areas were added to equations of the form of (1c), estimated coefficients for the profiles were reduced for each of the race/sex subsamples except white females. Of 336 observations in the white female group, 241 were classified in office specialties, with only 5 in agriculture and 10 in trade and industry. It is perhaps not surprising that the coefficients for vocational patterns were not much affected, since the estimated coefficient for office specialties--though negative--was small and not significant.

The agricultural specialty had significant positive effects for white males, increasing average weekly earnings by almost fifty-six dollars. Estimated coefficients for the other race/sex groups were negative, presumably reflecting a tendency for women and minority workers in agriculture to have low-paying or part-time work. One should not attach much weight to the large negative coefficient for minority women, for it was determined by only two cases.

TABLE 4.14

TOTAL EFFECTS ON USUAL WEEKLY EARNINGS (DOLLARS PER WEEK) NOT ENROLLED, EXACTLY TWELVE YEARS OF EDUCATION (EQUATION 1c) OLS

Education Variable	White Male	Minority Male	White Female	Minority Female
Concentrator	-19.05 (.8)	-44.98 (1.2)	21.00 (1.4)	51.68** (2.2)
Limited Concentrator	-15.51 (.7)	-33.28 (1.1)	8.95 (.6)	.19 (.0)
Concentrator/ Explorer	8.78 (.3)	-4.67 (.1)	11.48 (.8)	-.67 (.0)
Explorer+	21.51 (.5)	-75.93 (1.2)	21.65 (.7)	48.80 (1.3)
Incidental/ Personal	-4.36 (.2)	-15.68 (.5)	6.87 (.5)	6.02 (.3)
Training-related Placement	5.81 (.4)	26.07 (1.1)	7.03 (1.0)	10.65 (.9)
N	302	117	336	131
R^2	.06	.14	.07	.18
Adj. R^2	.01	.03	.03	.08
F	1.34	1.29	1.66	1.78

t-values in parentheses

** Significant at .05 level

+ Estimates for explorers are based on only 2 to 6 cases and should be interpreted cautiously

The equation controlled for region of residence, rural/urban residence, SES, class rank, and work experience.

TABLE 4.15

TOTAL EFFECTS ON USUAL WEEKLY EARNINGS
(DOLLARS PER WEEK)
NOT ENROLLED, EXACTLY TWELVE YEARS OF EDUCATION
(EQUATION 1c) OLS

Education Variable	White Male	Minority Male	White Female	Minority Female
Concentrator	-42.87 (1.5)	-42.06 (.9)	29.95* (1.8)	45.56* (1.9)
Limited Concentrator	-24.76 (1.0)	-32.59 (.8)	15.73 (1.0)	-8.35 (.4)
Concentrator/ Explorer	-4.94 (.2)	-.60 (.0)	19.34 (1.1)	-5.17 (.2)
Explorer	28.72+ (.6)	-72.91+ (1.2)	21.98+ (.7)	49.63+ (1.3)
Incidental/ Personal	-1.90 (.1)	-14.05 (.4)	12.71 (.9)	4.18 (.2)
Agriculture	55.96** (2.0)	-9.73+ (.2)	-1.19+ (.0)	-53.66+ (1.2)
Office	-13.16 (.6)	1.48 (.0)	-5.43 (.6)	16.04 (1.2)
Trade and Industry	24.82 (1.1)	26.59 (.8)	26.46+ (1.3)	41.39*+ (1.6)
N	302	117	336	131
R^2	.08	.14	.07	.21
Adj. R^2	.03	.02	.03	.10
F	1.58	1.13	1.58	1.88

t-values in parentheses
* Significant at .10 level
** Significant at .05 level
+ Estimate is for a cell with 10 or fewer cases and should be interpreted cautiously
The equations controlled for region of residence, rural/urban residence, SES, class rank, and work experience.

Office specialties showed no clear pattern. White men tend to earn less and minority women tend to earn more when they specialize in office areas. But neither effect was significant.

Specialization in trade and industry courses showed a consistent (if not strictly significant) association with higher weekly earnings. Estimates of the total effects range from twenty-five dollars to forty dollars per week. The female classes had few observations (ten white and six minority), but the general tendency seemed to be rather strong. Specialization in trade and industry was strongly correlated with employment in unionized jobs or in jobs in construction or durable manufacturing.

Some Additional Analyses

The comparison group can be extended to include all of those high school graduates who were not enrolled at the time of the survey rather than just those without any additional formal education. Some representative estimates from this expanded sample of the direct and total effects of participation in vocational education on weekly earnings are shown in table C.1 in Appendix C and can be briefly summarized here. For total effects, the clear differences in sign patterns by sex disappeared, as most coefficient estimates fell in absolute value and some with small magnitudes switched direction of sign. No coefficient differed significantly at the .05 level from zero. Only the white male coefficient for Concentrators remained significant at the .10 level. As before, however, when training-related placement was considered, coefficients for all race/sex groups were estimated to be positive, though none were statistically significant.

This change in estimates was to be expected to the extent that students with a concentration in vocational education tend to have a lower scholastic aptitude. Students with greater scholastic aptitude would seem to be likely on the average to obtain more education and to earn more regardless of educational level. Hence, expanding the comparison group to include respondents with more than twelve years of education makes the competition more difficult for participants in vocational education.

When hourly earnings were used as the dependent variable instead of weekly earnings, only for minority females were there statistically significant coefficients (positive for both Concentrators and Explorers). Negative coefficients for the pattern variables appeared more frequently here than for weekly earnings, but in most cases the estimates were low and, with one exception, not significant at the .10 level. The exception was an estimated total effect of -$1.04 per hour for white male Concentrators with exactly twelve years of education in an equation that included indicators of vocational program areas. These estimates are presented in table C.2 in Appendix C. It is difficult to draw any conclusion from the hourly earnings equations other than that participation in vocational education does not appear to have a significant impact--positively or negatively--on the hourly earnings of most employed people.

Estimates similar to those already discussed were made for the natural logs of hourly and weekly earnings. Those results are not presented here because the log form did not generally fit the data as well as did the regular units form discussed previously. The only exception to that rule is that, for minority women, all three vocational program area indicators were significant in the log form (OFFICE and TI positive, AG negative). But the coefficients of the vocational patterns were not significant in that case, and no important conclusions can be drawn from that curious finding.

The direct effects of participation in vocational education were also estimated for three measures of the length of time spent in employment or looking for work: weeks worked in the time between survey interviews, weeks unemployed during that same period, and hours usually worked per week on the current job. At the time of this writing, however, a satisfactory model specification had not been estimated, and no results are presented here.

It should be emphasized again that the earnings effects estimated here were for differences between respondents who fit the various patterns of participation and respondents who took no vocational courses. Coefficients that are not significantly different from zero do not imply that participation in vocational education has no absolute impact on earnings. They suggest, rather, that there is no difference between the effect of vocational and nonvocational courses. Because the sample for the regressions was restricted to respondents who completed exactly twelve years of education, the regressions offer no estimate of the absolute net return to education. Concentration in vocational education seemed to be strongly associated with positive differences in weekly earnings for women, more weakly associated with negative differences for men. Training-related placement was associated with small but positive differences in weekly earnings for both men and women. The next chapter considers the policy implications of these findings and of the findings concerning job characteristics, labor force status, and training-related placement.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

The effects of secondary vocational education on the labor market have been studied rather extensively by numerous investigators within recent years. The results have been mixed, sometimes positive and sometimes negative. In particular, the application of human capital theory has not produced evidence of strong economic returns for individual investment in vocational training. This new study was undertaken for two main reasons. First, the results of previous studies could be subjected to verification with a new, more recently collected set of data provided by the NLS Youth. Secondly, the frequently documented problem of inadequate definition of vocational education had been addressed in an earlier study in this series through the use of high school transcripts. The transcripts were used to identify patterns of participation in vocational education that took into account not only the number of credits but also the degree of specialization, the continuity of study, and the proximity of study to the time of seeking employment.

Classification by patterns of participation was therefore available within a subsample of high school graduates of the NLS Youth for use in analysis of the effects of secondary vocational education on labor market participation. Additionally, the possible explanatory effects of identifying the nature and limitations of the segment of the labor market into which vocational education graduates tend to move were developed and considered.

Against this background the effects were estimated for the following list of variables, with the labor market variables being those considered as dependent or criterion, against which the other effects were evaluated.

Labor Market Variables

- o Job characteristics
- o Labor force status
    - Employed
    - Unemployed
    - Out of the labor force
- o Training-related placement
- o Earnings

Educational and Individual Variables

- Educational
  - Degree of vocational training
  - Vocational program area
  - Academic ability
  - Postsecondary education
- Sex
- Race
- Family socioeconomic status
- Region of country
- Marital status
- Unionization
- Type of industry

Conclusions

Job Characteristics

Significant and policy relevant conclusions are supported by the results of this study. Beginning with job characteristics, the data show that a substantial majority of young people are in conventional or realistic jobs. Moreover, some concentrated involvement in vocational education is significantly more likely to be associated with employment in realistic or conventional jobs than is incidental participation or no participation at all. Further, among four patterns of participation, as the degree of concentration increases, the share of conventional jobs increases and the share of realistic jobs decreases in almost exact proportion. These conclusions become important when one considers that, among six categories of jobs, realistic and conventional occupations rank lowest and next lowest in prestige, and that secondary vocational education prepares students primarily for occupations of these types. In addition, the realistic and conventional occupations are also the lowest paid among the six types of occupations. Moving into the higher prestige types of jobs frequently requires extensive postsecondary education as demonstrated by both the GED and SVP average for these jobs. Also, there is some evidence that high family SES, discussed subsequently, provides the opportunity for such advanced training. The consequence of these conclusions are underscored by the analysis of labor market status and its associated conclusions.

Labor Force Status and Training-related Job Placement

Strong effects were found for conditions outside the direct control of vocational education. Being a member of a minority reduces the expectancy of being in the employed category by nearly 28 percent. Unemployment, rather than being out of the labor force, is the likely condition of the minority person who is not working. The unemployment effect is 27 percent, but the category of being out of the labor force is not significantly affected.

Being female also affects labor force status strongly but in a somewhat different way. There are no significant effects of being female on unemployment, but there is a 21 percent greater expectancy of being out of the labor force than would be the case if sex had no effect.

Family SES also affects being out of the labor force, increasing this likelihood by 17 percent for high SES respondents. Family SES and sex, taken together, have a significant additional effect on being out of the labor force. High SES males and low SES females have an increased expectancy of being in an out-of-the-labor-force category of 14 percent. Family SES and race have another form of negative impact. Low SES whites and high SES minorities are more likely to be unemployed and less likely to be out of the labor force.

The vocational participation effects on labor market status are few. Incidental or nonparticipation in vocational education contributes strongly to being out of the labor force. Although none of the remaining effects are individually significant, for those individuals who have sufficient participation in vocational education to be classified at or above the concentration level of Concentrator/Explorer, there is a consistently greater expectancy of being in an employed category and a consistently reduced expectancy of being out of the labor force.

When the subsample of graduates who had developed a vocational specialty is considered, the foregoing general findings still hold, and additional information on training-related employment is added. There is a strong positive likelihood of being in training-related employment for Concentrators; a positive and still significant likelihood for Limited Concentrators. Low SES males and high SES females also show greater tendencies to be in training-related employment. Explanation of this finding must be confined to speculation, but it appears possible that high SES males may be channeled out of vocational education to a greater degree than high SES females, therefore allowing the strong association of vocational concentration to produce the differential tendency reported here.

There is a negative effect on being in training-related employment if the respondent is a minority member, but the positive effect of being a Concentrator is more than sufficient to offset the minority effect on training-related placement. There is no significant interaction between race and vocational participation that might reduce the capacity of concentration to offset the effect of being minority.

When the two specialties that involve the largest number of students are considered, office and trade and industry, no new effects for nonvocational variables emerge. The patterns detected in the larger samples remain. The principal conclusions are that after sex is controlled for, having an office specialty has an additional significant and strong effect in the direction of being out of the labor force, and that there is a tendency toward higher unemployment for trade and industry trained graduates, who are more likely to be in the labor force than those with training in the office specialties.

Earnings

The effect of vocational participation on earnings was examined separately for direct effects and total effects. In terms of direct effects, concentration and limited concentration tend to be weakly associated with lower weekly earnings for men and somewhat more strongly associated with higher weekly earnings for women (significantly higher for minority women Concentrators). When total effects are examined, these results appear stronger, with female Concentrators earning significantly more per week than women with no vocational education. The addition of a variable for training-related placement does not produce an additional significant explanation, but does indicate a consistent tendency for persons in training-related jobs to be associated with higher weekly earnings. The patterns of participation in vocational education do not have a generally significant effect--positive or negative--on the hourly earnings of most people, but rather show such an impact on certain relatively small subgroups.

When the conclusions from these three areas of analysis are viewed together, it may be seen that the demonstrated net effect is that whereas most trends are in the expected positive directions for vocationally trained graduates, vocational training is not a powerful enough effect to offset the disadvantages of minority status and low SES. The significant positive effect of concentration in vocational education on training-related placement, the tendency of training-related placement to be associated with slightly higher earnings, and the significantly positive earnings results for vocationally trained minority women suggest the directions in which policies for improvement ought to move. Further, the restraints that the labor market itself appears to impose on persons seeking employment and the kinds of jobs available to vocationally trained graduates suggest additional policy directions that affect vocational education but also go beyond it.

Policy Recommendations

Specifically, the areas that policy should address in the context of these findings are as follows:

- Job Characteristics

  The low prestige and low pay associated with vocational training related jobs should be mitigated by a policy that encourages the valuing of jobs in terms of their contribution to society rather than the ease with which they may be filled. Encouraging the development of pride in craftsmanship and organizing work so that this may occur are possible elements to be considered. Although the economic returns of such a policy may be very indirect, a humanitarian concern for the quality of life among workers is a worthwhile social goal. Also, recognition of the essential value of vast numbers of low prestige jobs is past due in our society. Simple steps such as recognizing the work of secretaries by a "document prepared by . . ." line, could move us in this direction.

  Careful matching of training content to employer needs, emphasis on productivity and quality, and enhanced contact between employers and students might be elements of policy that could be implemented by vocational educators. These steps should not be taken, however, without equal attention to equipping the vocational education graduate not only with immediately useable skills but also with transferable skills, including careful attention to preparation for retraining when changes in technology require it. Supportive counseling that would encourage long term concern for life goals should also be an element in this policy.

- Labor Market Status

  Labor market entry appears to be the main point to be stressed in relation to the conclusions developed from analyses in this area. In particular, the negative situation for minorities, regardless of training, should be a focus of policy. The policy should be directed toward changing the reluctance of employers to hire youth, minority or not; the young worker's behavior that mistakenly or correctly underlies that reluctance; and the structure of the job market for young workers. As Thurow (1979) argues, employers may hire the ability to be trained rather than existing skills.

The careful matching of the content of a training program with the needs of employers and increased employer awareness of this match should be elements addressed by policy in this area. Training-related employment appears to be the most promising avenue for dealing with the labor market, because it is an area in which vocational education has a demonstrated effect.

If related employment, however, is not available outside the low prestige, low pay areas, the extent to which vocational education is able to solve the larger societal problem of the character of the youth labor market is limited. Policy therefore should not direct the evaluation of vocational education toward objectives it cannot attain. But, within this limitation, tailoring training to available jobs, although guarding against a too narrow development of skills, should be a useful objective of policy.

- Earnings

The significant positive earnings difference for women Concentrators is encouraging for the vocational education system. The absence of effects on earnings for men is perhaps the most difficult conclusion for policy to deal with. It may be a function of the practice of awarding wages to classes of employees without regard to individual productivity or a function of the valuing of the the occupations for which vocational graduates are trained. Neither is directly addressable by policy for vocational education. However, emphasis on training for more highly esteemed occupations or on occupations whose rewards are more closely linked to productivity seems to be a reasonable policy consideration. In addition, flexibility and transferability of skills are highly important objectives.

In conclusion, it should be pointed out that this research activity suggests the necessity for changes in both vocational education as it is presently practiced and in certain practices that appear to be common in the labor market. It remains unknown whether the results may also be in part determined by individual and societal constraints that operate prior to the time when the decision is made to enter a program of vocational education. That is an important subject for further research. It is also important to investigate the effect of participation in vocational education on a person's postsecondary educational attainment, for educational attainment does appear to have an influence on the type of job that one works in and the remuneration that is received. That investigation is the subject of the third paper for this project. Even before these other issues are investigated, however, it remains clear that, for vocational education to have an adequate return on investment in terms of the labor market experience, changes are in order.

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APPENDIX A

GENERAL EDUCATION DEVELOPMENT AND SPECIFIC VOCATIONAL PREPARATION

APPENDIX A

GENERAL EDUCATION DEVELOPMENT AND SPECIFIC VOCATIONAL PREPARATION

TABLE A.1: SCALE OF GENERAL EDUCATION DEVELOPMENT (GED)

Level	Reasoning Development	Mathematical Development	Language Development
6	Apply principles of logical or scientific thinking to a wide range of intellectual and practical problems. Deal with nonverbal symbolism (formulas, scientific equations, graphs, musical notes, etc.) in its most difficult phases. Deal with a variety of abstract and concrete variables. Apprehend the most abstruse classes of concepts.	Apply knowledge of advanced mathematical and statistical techniques such as differential and integral calculus, factor analysis, and probability determination, or work with a wide variety of theoretical mathematical concepts and make original applications of mathematical procedures, as in empirical and differential equations.	Comprehension and expression of a level to— —Report, write, or edit articles for such publications as newspapers, magazines, and technical or scientific journals. Prepare and draw up deeds, leases, wills, mortgages, and contracts. —Prepare and deliver lectures on politics, economics, education, or science. —Interview, counsel, or advise such people as students, clients, or patients, in such matters as welfare eligibility, vocational rehabilitation, mental hygiene, or marital relations. —Evaluate engineering technical data to design buildings and bridges.
5	Apply principles of logical or scientific thinking to define problems, collect data, establish facts, and draw valid conclusions. Interpret an extensive variety of technical instructions, in books, manuals, and mathematical or diagrammatic form. Deal with several abstract and concrete variables.		
4	Apply principles of rational systems[1] to solve practical problems and deal with a variety of concrete variables in situations where only limited standardization exists. Interpret a variety of instructions furnished in written, oral, diagrammatic, or schedule form.	Perform ordinary arithmetic, algebraic, and geometric procedures in standard, practical applications.	Comprehension and expression of a level to— —Transcribe dictation, make appointments for executive and handle his personal mail, interview and screen people wishing to speak to him, and write routine correspondence on own initiative. —Interview job applicants to determine work best suited for their abilities and experience, and contact employers to interest them in services of agency. —Interpret technical manuals as well as drawings and specifications, such as layouts, blueprints, and schematics.
3	Apply common sense understanding to carry out instructions furnished in written, oral, or diagrammatic form. Deal with problems involving several concrete variables in or from standardized situations.	Make arithmetic calculations involving fractions, decimals, and percentages.	Comprehension and expression of a level to— —File, post, and mail such material as forms, checks, receipts, and bills. —Copy data from one record to another, fill in report forms, and type all work from rough draft or corrected copy. —Interview members of household to obtain such information as age, occupation, and number of children, to be used as data for surveys or economic studies. —Guide people on tours through historical or public buildings, describing such features as size, value, and points of interest.
2	Apply common sense understanding to carry out detailed but uninvolved written or oral instructions. Deal with problems involving a few concrete variables in or from standardized situations.	Use arithmetic to add, subtract, multiply, and divide whole numbers.	
1	Apply common sense understanding to carry out simple one- or two-step instructions. Deal with standardized situations with occasional or no variables in or from these situations encountered on the job.	Perform simple addition and subtraction, reading and copying of figures, or counting and recording.	Comprehension and expression of a level to— —Learn job duties from oral instructions or demonstration. —Write identifying information, such as name and address of customer, weight, number, or type of product, on tags or slips. —Request orally, or in writing, such supplies as linen, soap, or work materials.

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[1] Examples of "principles of rational systems" are: Bookkeeping, internal combustion engines, electric wiring systems, house building, nursing, farm management, ship sailing.

APPENDIX A
(Continued)

TABLE A.2: SCALE OF SPECIFIC VOCATIONAL PREPARATION (SVP)

Level	Equivalent Years
9	Over 10 years
8	Over 4 years up to and including 10 years
7	Over 2 years up to and including 4 years
6	Over 1 year up to and including 2 years
5	Over 6 months up to and including 1 year
4	Over 3 months up to and including 6 months
3	Over 30 days up to and including 3 months
2	Anything beyond short demonstrations up to and including 30 days
1	Short demonstration only

SOURCE: U.S. Department of Labor (1977).

APPENDIX B

LOG LINEAR TABLES

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APPENDIX B

LOG LINEAR TABLES

TABLE B.1: COMPLETE TABLE 4.8
LOG-LINEAR MODEL: FP, FSL, FRL, SPL

Model fit:		
	Degrees of Freedom	57
	Likelihood Ratio Chi square	54.11
	Probability	.584
	Pearson Chi square	51.98
	Probability	.663

Variable Name	(Symbol)	Variable Categories	(Symbol)
Labor Force Status			
LMSTAT3	(L)	Out of the labor force	(OLF)
		Employed	(EMP)
		Unemployed	(UNEMP)
Patterns of Vocational Participation			
PROFILE	(P)	Concentrator	(C)
		Limited Concentrator	(LC)
		Concentrator/Explorer	(LE)
		Explorer, Incidental/ Personal, and non-vocational	(ELSE)
Race			
MINORITY	(R)	White	(WHITE)
		Black and Hispanic	(MINORITY)
Sex			
SEX	(S)	Male	(MALE)
		Female	(FEMALE)
Family Socioeconomic Status			
SES	(F)	Low	(LO)
		High	(HIGH)

Table B.1

```
     THE FITTED VALUES
LMSTAT3  PROFILE  MINORITY SEX      I   SES      (F)
   L        P        R        S     I    LO        HIGH
-----------------------------------------------------------
OLF      C        WHITE     MALE    I    4.994     9.354
                            FEMALE  I   16.669    15.666
                                    I
                  MINORITY  MALE    I    1.939     0.713
                            FEMALE  I    6.471     1.194
                  ------------------I------------------
         LC       WHITE     MALE    I    5.965    15.535
                            FEMALE  I   26.119    34.139
                                    I
                  MINORITY  MALE    I    2.316     1.184
                            FEMALE  I   10.140     2.603
                  ------------------I------------------
         CE       WHITE     MALE    I    2.697     8.342
                            FEMALE  I   15.970    23.072
                                    I
                  MINORITY  MALE    I    1.125     0.636
                            FEMALE  I    6.200     1.759
                  ------------------I------------------
         ELSE     WHITE     MALE    I   37.288   187.911
                            FEMALE  I   60.099   151.982
                                    I
                  MINORITY  MALE    I   14.477    14.325
                            FEMALE  I   23.332    11.586
                  ------------------I------------------
         ---------------------------I------------------
EMP      C        WHITE     MALE    I   49.197    39.047
                            FEMALE  I   72.293    57.047
                                    I
                  MINORITY  MALE    I   12.198     2.557
                            FEMALE  I   17.924     3.736
                  ------------------I------------------
         LC       WHITE     MALE    I   75.081    82.876
                            FEMALE  I   97.217   106.691
                                    I
                  MINORITY  MALE    I   18.616     5.427
                            FEMALE  I   24.104     6.987
                  ------------------I------------------
         CE       WHITE     MALE    I   33.753    41.181
                            FEMALE  I   59.045    71.624
                                    I
                  MINORITY  MALE    I    8.369     2.697
                            FEMALE  I   14.640     4.690
                  ------------------I------------------
         ELSE     WHITE     MALE    I  192.144   410.343
                            FEMALE  I  151.270   321.190

                  MINORITY  MALE    I   47.641    26.872
                            FEMALE  I   37.507    21.034
                  ------------------I------------------
```

Table B.1

The Fitted Values

UNEMP	C	WHITE	MALE	5.218	2.165
			FEMALE	10.637	4.915
		MINORITY	MALE	2.126	0.491
			FEMALE	4.333	1.115
	LC	WHITE	MALE	6.146	3.546
			FEMALE	15.484	9.951
		MINORITY	MALE	2.504	0.804
			FEMALE	6.308	2.257
	CE	WHITE	MALE	5.936	3.786
			FEMALE	6.143	4.364
		MINORITY	MALE	2.418	0.859
			FEMALE	2.503	0.990
	ELSE	WHITE	MALE	34.568	38.595
			FEMALE	23.868	29.677
		MINORITY	MALE	14.083	8.753
			FEMALE	9.724	6.731

Table B.1

```
THETA (MEAN) -------      2.373

          ESTIMATES OF THE LOG-LINEAR PARAMETERS (LAMBDA)
SES      (F)
    LO         HIGH
-------------------------
    0.206    -0.206
-------------------------

          ESTIMATES OF THE LOG-LINEAR PARAMETERS (LAMBDA)
SEX      (S)
    MALE       FEMALE
-------------------------
   -0.248     0.248
-------------------------


          ESTIMATES OF THE LOG-LINEAR PARAMETERS (LAMBDA)
MINORITY(R)
    WHITE      MINORITY
-------------------------
    0.835    -0.835
-------------------------


          ESTIMATES OF THE LOG-LINEAR PARAMETERS (LAMBDA)
PROFILE (P)
    C          LC         CE         ELSE
-----------------------------------------------
   -0.568    -0.089    -0.618     1.275
-----------------------------------------------


          ESTIMATES OF THE LOG-LINEAR PARAMETERS (LAMBDA)
LMSTAT3 (L)
    OLF        EMP        UNEMP
------------------------------------
   -0.265     1.067    -0.802
------------------------------------


          ESTIMATES OF THE LOG-LINEAR PARAMETERS (LAMBDA)
SEX        I   SES        (F)
     S     I    LO         HIGH
------------------------------------
MALE       I   -0.049     0.049
FEMALE     I    0.049    -0.049
------------------------------------


          ESTIMATES OF THE LOG-LINEAR PARAMETERS (LAMBDA)
MINORITYI   SES        (F)
     R     I    LO         HIGH
------------------------------------
WHITE      I   -0.295     0.295
MINORITYI       0.295    -0.295
------------------------------------


          ESTIMATES OF THE LOG-LINEAR PARAMETERS (LAMBDA)
PROFILE    I   SES        (F)
     P     I    LO         HIGH
------------------------------------
C          I    0.219    -0.219
LC         I    0.054    -0.054
CE         I    0.004    -0.004
ELSE       I   -0.276     0.276
------------------------------------
```

Table B.1

```
         ESTIMATES OF THE LOG-LINEAR PARAMETERS (LAMBDA)
LMSTAT3  I   SES       (F)
   L     I   LO          HIGH
-------------------------------
OLF      I   -0.159    0.159
EMP      I    0.025   -0.025
UNEMP    I    0.134   -0.134
-------------------------------
```

```
         ESTIMATES OF THE LOG-LINEAR PARAMETERS (LAMBDA)
PROFILE  I   SEX       (S)
   P     I   MALE       FEMALE
-------------------------------
C        I   -0.087    0.087
LC       I   -0.146    0.146
CE       I   -0.086    0.086
ELSE     I    0.319   -0.319
-------------------------------
```

```
         ESTIMATES OF THE LOG-LINEAR PARAMETERS (LAMBDA)
LMSTAT3  I   SEX       (S)
   L     I   MALE       FEMALE
-------------------------------
OLF      I   -0.188    0.188
EMP      I    0.129   -0.129
UNEMP    I    0.059   -0.059
-------------------------------
```

```
         ESTIMATES OF THE LOG-LINEAR PARAMETERS (LAMBDA)
LMSTAT3  I   MINORITY(R)
   L     I   WHITE     MINORITY
-------------------------------
OLF      I    0.045   -0.045
EMP      I    0.195   -0.195
UNEMP    I   -0.240    0.240
-------------------------------
```

```
         ESTIMATES OF THE LOG-LINEAR PARAMETERS (LAMBDA)
LMSTAT3  I   PROFILE (P)
   L     I   C          LC          CE          ELSE
------------------------------------------------------
OLF      I   -0.067    -0.068     -0.096       0.231
EMP      I    0.070     0.115      0.044      -0.229
UNEMP    I   -0.003    -0.047      0.052      -0.002
------------------------------------------------------
```

Table B.1

```
     ESTIMATES OF THE LOG-LINEAR PARAMETERS (LAMBDA)
LMSTAT3   SEX       I   SES       (F)
   L          S     I   LO          HIGH
---------------------------------------------
OLF       MALE      I   -0.123     0.123
          FEMALE    I    0.123    -0.123
                    I
EMP       MALE      I    0.048    -0.048
          FEMALE    I   -0.048     0.048
                    I
UNEMP     MALE      I    0.076    -0.076
          FEMALE    I   -0.076     0.076
---------------------------------------------

     ESTIMATES OF THE LOG-LINEAR PARAMETERS (LAMBDA)
LMSTAT3   MINORITYI   SES       (F)
   L          R     I   LO          HIGH
---------------------------------------------
OLF       WHITE     I   -0.112     0.112
          MINORITYI      0.112    -0.112
                    I
EMP       WHITE     I   -0.037     0.037
          MINORITYI      0.037    -0.037
                    I
UNEMP     WHITE     I    0.149    -0.149
          MINORITYI     -0.149     0.149
---------------------------------------------

     ESTIMATES OF THE LOG-LINEAR PARAMETERS (LAMBDA)
LMSTAT3   PROFILE   I   SEX       (S)
   L          P     I   MALE        FEMALE
---------------------------------------------
OLF       C         I    0.092    -0.092
          LC        I    0.016    -0.016
          CE        I   -0.159     0.159
          ELSE      I    0.051    -0.050
                    I
EMP       C         I    0.015    -0.015
          LC        I    0.137    -0.137
          CE        I   -0.073     0.073
          ELSE      I   -0.079     0.079
                    I
UNEMP     C         I   -0.107     0.107
          LC        I   -0.153     0.153
          CE        I    0.232    -0.232
          ELSE      I    0.029    -0.029
---------------------------------------------
```

Table B.1

The fitted model is not direct; therefore, the variance of lambda is computed using the direct model - FSPL, FRL.

Estimates of the Log-Linear Parameters Divided by their Standard Errors

```
SES        (F)
   LO          HIGH
-------------------------
   4.292     -4.292
-------------------------


SEX        (S)
   MALE        FEMALE
-------------------------
  -5.799       5.799
-------------------------


MINORITY(R)
   WHITE       MINORITY
-------------------------
  24.921     -24.921
-------------------------


PROFILE  (P)
   C           LC          CE          ELSE
--------------------------------------------------
  -6.288      -1.281      -7.626      26.173
--------------------------------------------------


LMSTAT3  (L)
   OLF         EMP         UNEMP
-------------------------------------
  -4.024      19.998      -9.830
-------------------------------------


SEX         I   SES        (F)
    S       I   LO             HIGH
-------------------------------------
MALE        I   -1.145        1.145
FEMALE      I    1.145       -1.145
-------------------------------------


MINORITYI   SES        (F)
    R   I   LO             HIGH
-------------------------------------
WHITE   I   -8.815        8.815
MINORITYI    8.815       -8.815
-------------------------------------
```

Table B.1

Estimates of the Log-Linear Parameters Divided by their Standard Errors

```
PROFILE  I   SES        (F)
    P    I    LO           HIGH
------------------------------------
C        I     2.420      -2.420
LC       I     0.771      -0.772
CE       I     0.046      -0.046
ELSE     I    -5.668       5.668
------------------------------------

LMSTAT3  I   SES        (F)
   L     I    LO           HIGH
------------------------------------
OLF      I    -2.416       2.416
EMP      I     0.467      -0.467
UNEMP    I     1.648      -1.648
------------------------------------

PROFILE  I   SEX        (S)
    P    I    MALE         FEMALE
------------------------------------
C        I    -0.959       0.959
LC       I    -2.096       2.096
CE       I    -1.066       1.066
ELSE     I     6.549      -6.549
------------------------------------

LMSTAT3  I   SEX        (S)
   L     I    MALE         FEMALE
------------------------------------
OLF      I    -3.270       3.270
EMP      I     2.827      -2.827
UNEMP    I     0.784      -0.784
------------------------------------

LMSTAT3  I   MINORITY(R)
   L     I    WHITE        MINORITY
------------------------------------
OLF      I     0.952      -0.952
EMP      I     4.925      -4.925
UNEMP    I    -4.414       4.414
------------------------------------

LMSTAT3  I   PROFILE (P)
   L     I    C            LC           CE             ELSE
-------------------------------------------------------------
OLF      I    -0.583      -0.677      -0.673          3.525
EMP      I     0.728       1.546       0.509         -4.338
UNEMP    I    -0.016      -0.404       0.370         -0.023
-------------------------------------------------------------
```

Table B.1

Estimates of the Log-Linear Parameters Divided
by their Standard Errors

```
LMSTAT3   SEX        I   SES         (F)
   L           S     I    LO          HIGH
--------------------------------------------
OLF       MALE       I   -2.149      2.149
          FEMALE     I    2.149     -2.149
                     I
EMP       MALE       I    1.040     -1.040
          FEMALE     I   -1.040      1.040
                     I
UNEMP     MALE       I    1.014     -1.014
          FEMALE     I   -1.014      1.014
--------------------------------------------
```

```
LMSTAT3   MINORITYI  SES         (F)
   L           R  I   LO          HIGH
--------------------------------------------
OLF       WHITE   I  -2.367      2.367
          MINORITYI   2.367     -2.367
                  I
EMP       WHITE   I  -0.946      0.946
          MINORITYI   0.946     -0.946
                  I
UNEMP     WHITE   I   2.742     -2.742
          MINORITYI  -2.742      2.742
--------------------------------------------
```

```
LMSTAT3   PROFILE I   SEX        (S)
   L           P  I    MALE        FEMALE
--------------------------------------------
OLF       C       I    0.805      -0.805
          LC      I    0.160      -0.160
          CE      I   -1.441       1.442
          ELSE    I    0.772      -0.771
                  I
EMP       C       I    0.153      -0.153
          LC      I    1.848      -1.848
          CE      I   -0.836       0.836
          ELSE    I   -1.499       1.500
                  I
UNEMP     C       I   -0.654       0.654
          LC      I   -1.314       1.314
          CE      I    1.654      -1.654
          ELSE    I    0.338      -0.338
--------------------------------------------
```

Table B.1

```
THETA (MEAN) -------    10.727

          ESTIMATES OF THE MULTIPLICATIVE PARAMETERS (BETA)
SES            (F)
     LO             HIGH
-----------------------------
     1.229          0.814
-----------------------------

          ESTIMATES OF THE MULTIPLICATIVE PARAMETERS (BETA)
SEX            (S)
     MALE           FEMALE
-----------------------------
     0.780          1.282
-----------------------------

          ESTIMATES OF THE MULTIPLICATIVE PARAMETERS (BETA)
MINORITY(R)
     WHITE          MINORITY
-----------------------------
     2.305          0.434
-----------------------------

          ESTIMATES OF THE MULTIPLICATIVE PARAMETERS (BETA)
PROFILE (P)
     C              LC             CE             ELSE
---------------------------------------------------------
     0.566          0.915          0.539          3.580
---------------------------------------------------------

          ESTIMATES OF THE MULTIPLICATIVE PARAMETERS (BETA)
LMSTAT3 (L)
     OLF            EMP            UNEMP
------------------------------------------
     0.767          2.907          0.448
------------------------------------------

          ESTIMATES OF THE MULTIPLICATIVE PARAMETERS (BETA)
SEX          I  SES         (F)
     S       I  LO          HIGH
----------------------------------------
MALE         I  0.952       1.050
FEMALE       I  1.050       0.952
----------------------------------------

          ESTIMATES OF THE MULTIPLICATIVE PARAMETERS (BETA)
MINORITYI  SES         (F)
     R       I  LO          HIGH
----------------------------------------
WHITE        I  0.744       1.344
MINORITYI       1.344       0.744
----------------------------------------
```

Table B.1

```
          ESTIMATES OF THE MULTIPLICATIVE PARAMETERS (BETA)
PROFILE I  SES       (F)
      P   I   LO          HIGH
--------------------------------
C         I   1.244       0.804
LC        I   1.055       0.948
CE        I   1.004       0.996
ELSE      I   0.759       1.318
--------------------------------

          ESTIMATES OF THE MULTIPLICATIVE PARAMETERS (BETA)
LMSTAT3 I  SES       (F)
      L   I   LO          HIGH
--------------------------------
OLF       I   0.853       1.173
EMP       I   1.025       0.975
UNEMP     I   1.144       0.874
--------------------------------

          ESTIMATES OF THE MULTIPLICATIVE PARAMETERS (BETA)
PROFILE I  SEX       (S)
      P   I   MALE        FEMALE
--------------------------------
C         I   0.917       1.091
LC        I   0.864       1.157
CE        I   0.917       1.090
ELSE      I   1.376       0.727
--------------------------------

          ESTIMATES OF THE MULTIPLICATIVE PARAMETERS (BETA)
LMSTAT3 I  SEX       (S)
      L   I   MALE        FEMALE
--------------------------------
OLF       I   0.829       1.207
EMP       I   1.138       0.879
UNEMP     I   1.060       0.943
--------------------------------

          ESTIMATES OF THE MULTIPLICATIVE PARAMETERS (BETA)
LMSTAT3 I  MINORITY(R)
      L   I   WHITE       MINORITY
--------------------------------
OLF       I   1.046       0.956
EMP       I   1.215       0.823
UNEMP     I   0.787       1.271
--------------------------------

          ESTIMATES OF THE MULTIPLICATIVE PARAMETERS (BETA)
LMSTAT3 I  PROFILE (P)
      L   I   C           LC          CE          ELSE
--------------------------------------------------------
OLF       I   0.935       0.935       0.908       1.260
EMP       I   1.072       1.122       1.045       0.795
UNEMP     I   0.997       0.954       1.053       0.998
--------------------------------------------------------
```

Table B.1

```
        ESTIMATES OF THE MULTIPLICATIVE PARAMETERS (BETA)
LMSTAT3   SEX        I   SES       (F)
   L         S       I   LO         HIGH
---------------------------------------------
OLF       MALE       I   0.884      1.131
          FEMALE     I   1.131      0.884
                     I
EMP       MALE       I   1.049      0.954
          FEMALE     I   0.954      1.049
                     I
UNEMP     MALE       I   1.079      0.927
          FEMALE     I   0.927      1.079
---------------------------------------------
```

```
        ESTIMATES OF THE MULTIPLICATIVE PARAMETERS (BETA)
LMSTAT3   MINORITYI   SES       (F)
   L           R  I   LO         HIGH
---------------------------------------------
OLF       WHITE    I   0.894      1.118
          MINORITYI   1.118      0.894
                   I
EMP       WHITE    I   0.963      1.038
          MINORITYI   1.038      0.963
                   I
UNEMP     WHITE    I   1.161      0.862
          MINORITYI   0.862      1.161
---------------------------------------------
```

```
        ESTIMATES OF THE MULTIPLICATIVE PARAMETERS (BETA)
LMSTAT3   PROFILE I   SEX       (S)
   L          P   I   MALE       FEMALE
---------------------------------------------
OLF       C       I   1.097      0.912
          LC      I   1.016      0.984
          CE      I   0.853      1.172
          ELSE    I   1.052      0.951
                  I
EMP       C       I   1.015      0.985
          LC      I   1.147      0.872
          CE      I   0.930      1.076
          ELSE    I   0.924      1.082
                  I
UNEMP     C       I   0.899      1.113
          LC      I   0.858      1.166
          CE      I   1.261      0.793
          ELSE    I   1.029      0.972
---------------------------------------------
```

TABLE B.2: COMPLETE TABLE 4.9
LOG-LINEAR MODEL: PL, FP, FSL, FRL

Model fit:	Degrees of Freedom	62
	Likelihood Ratio Chi square	57.24
	Probability	.647
	Pearson Chi square	55.91
	Probability	.693

Variable Name	(Symbol)	Variable Categories	(Symbol)
Labor Force Status			
LMSTAT4	(L)	Out of the Labor Force	(OLF)
		Training-related employment	(EMPREL)
		Unrelated employment	(EMPNOREL)
		Unemployed	(UNEMP)
Patterns of Vocational Participation			
PROFILE	(P)	Concentrator	(C)
		Limited Concentrator	(LC)
		Concentrator/Explorer and Incidental/Personal	(CEIP)
Race			
MINORITY	(R)	White	(WHITE)
		Black and Hispanic	(MINORITY)
Sex			
SEX	(S)	Male	(MALE)
		Female	(FEMALE)
Family Socioeconomic Status			
SES	(F)	Low	(LO)
		High	(HIGH)

Table B.2

```
THE FITTED VALUES

LMSTAT4   PROFILE  MINORITY SEX      I  SES       (F)
   L         P        R          S   I   LO         HIGH
--------------------------------------------------------------
OLF       C        WHITE    MALE     I    4.463     9.886
                            FEMALE   I   17.039    16.271
                                     I
                   MINORITY MALE     I    1.707     0.799
                            FEMALE   I    6.519     1.316
                   ------------------I--------------------
          LC       WHITE    MALE     I    6.547    19.718
                            FEMALE   I   24.996    32.453
                                     I
                   MINORITY MALE     I    2.505     1.594
                            FEMALE   I    9.564     2.624
                   ------------------I--------------------
          CEIP     WHITE    MALE     I   12.859    59.214
                            FEMALE   I   49.097    97.457
                                     I
                   MINORITY MALE     I    4.920     4.788
                            FEMALE   I   18.785     7.879
                   ------------------I--------------------
          ---------------------------I--------------------
EMPREL    C        WHITE    MALE     I   35.900    25.789
                            FEMALE   I   50.785    42.925
                                     I
                   MINORITY MALE     I    9.812     1.842
                            FEMALE   I   13.880     3.066
                   ------------------I--------------------
          LC       WHITE    MALE     I   43.835    42.814
                            FEMALE   I   62.010    71.263
                                     I
                   MINORITY MALE     I   11.981     3.058
                            FEMALE   I   16.948     5.090
                   ------------------I--------------------
          CEIP     WHITE    MALE     I   49.063    73.263
                            FEMALE   I   69.407   121.945
                                     I
                   MINORITY MALE     I   13.410     5.233
                            FEMALE   I   18.970     8.710
                   ------------------I--------------------
```

Table B.2

The Fitted Values

EMPNOREL	C	WHITE	MALE	18.144	15.825
			FEMALE	21.232	15.740
		MINORITY	MALE	3.629	1.095
			FEMALE	4.246	1.089
	LC	WHITE	MALE	35.066	41.583
			FEMALE	41.034	41.360
		MINORITY	MALE	7.013	2.876
			FEMALE	8.207	2.861
	CEIP	WHITE	MALE	64.290	116.559
			FEMALE	75.234	115.932
		MINORITY	MALE	12.858	8.062
			FEMALE	15.047	8.018
UNEMP	C	WHITE	MALE	6.279	2.899
			FEMALE	9.955	3.499
		MINORITY	MALE	2.479	0.887
			FEMALE	3.930	1.071
	LC	WHITE	MALE	8.679	5.448
			FEMALE	13.759	6.575
		MINORITY	MALE	3.426	1.668
			FEMALE	5.431	2.013
	CEIP	WHITE	MALE	14.438	13.856
			FEMALE	22.889	16.723
		MINORITY	MALE	5.699	4.242
			FEMALE	9.035	5.119

Table B.2

```
THETA (MEAN) -------     2.346

           ESTIMATES OF THE LOG-LINEAR PARAMETERS (LAMBDA)
SES        (F)
   LO          HIGH
-----------------------
   0.215     -0.215
-----------------------

           ESTIMATES OF THE LOG-LINEAR PARAMETERS (LAMBDA)
SEX        (S)
   MALE        FEMALE
-----------------------
  -0.218      0.218
-----------------------

           ESTIMATES OF THE LOG-LINEAR PARAMETERS (LAMBDA)
MINORITY(R)
   WHITE       MINORITY
-----------------------
   0.863     -0.863
-----------------------

           ESTIMATES OF THE LOG-LINEAR PARAMETERS (LAMBDA)
PROFILE (P)
   C           LC          CEIP
----------------------------------
  -0.593     -0.048      0.640
----------------------------------

           ESTIMATES OF THE LOG-LINEAR PARAMETERS (LAMBDA)
LMSTAT4 (L)
   OLF         EMPREL      EMPNUREL UNEMP
---------------------------------------------
  -0.208      0.644      0.267    -0.702
---------------------------------------------

           ESTIMATES OF THE LOG-LINEAR PARAMETERS (LAMBDA)
SEX        I  SES        (F)
    S      I   LO          HIGH
-----------------------------------
MALE       I  -0.070      0.070
FEMALE     I   0.070     -0.070
-----------------------------------

           ESTIMATES OF THE LOG-LINEAR PARAMETERS (LAMBDA)
MINORITYI  SES        (F)
    R    I   LO          HIGH
-----------------------------------
WHITE    I  -0.263      0.263
MINORITYI    0.263     -0.263
-----------------------------------

           ESTIMATES OF THE LOG-LINEAR PARAMETERS (LAMBDA)
PROFILE  I  SES        (F)
    P    I   LO          HIGH
-----------------------------------
C        I   0.173     -0.173
LC       I   0.020     -0.020
CEIP     I  -0.193      0.193
-----------------------------------
```

Table B.2

```
           ESTIMATES OF THE LOG-LINEAR PARAMETERS (LAMBDA)
LMSTAT4  I   SES       (F)
    L    I   LO          HIGH
-------------------------------
OLF      I   -0.187      0.187
EMPREL   I    0.072     -0.072
EMPNORELI    -0.014      0.014
UNEMP    I    0.130     -0.130
-------------------------------
```

```
           ESTIMATES OF THE LOG-LINEAR PARAMETERS (LAMBDA)
LMSTAT4  I   SEX       (S)
    L    I   MALE        FEMALE
-------------------------------
OLF      I   -0.241      0.241
EMPREL   I    0.004     -0.004
EMPNORELI     0.180     -0.180
UNEMP    I    0.056     -0.056
-------------------------------
```

```
           ESTIMATES OF THE LOG-LINEAR PARAMETERS (LAMBDA)
LMSTAT4  I   MINORITY(R)
    L    I   WHITE       MINORITY
-------------------------------
OLF      I    0.006     -0.006
EMPREL   I    0.121     -0.121
EMPNORELI     0.207     -0.207
UNEMP    I   -0.335      0.335
-------------------------------
```

```
           ESTIMATES OF THE LOG-LINEAR PARAMETERS (LAMBDA)
LMSTAT4  I   PROFILE (P)
    L    I   C           LC          CEIP
-------------------------------------------
OLF      I   -0.061     -0.069      0.130
EMPREL   I    0.249      0.057     -0.306
EMPNORELI    -0.222      0.046      0.176
UNEMP    I    0.034     -0.034     -0.000
-------------------------------------------
```

```
           ESTIMATES OF THE LOG-LINEAR PARAMETERS (LAMBDA)
LMSTAT4   SEX        I   SES       (F)
    L          S     I   LO          HIGH
-------------------------------------------
OLF       MALE       I   -0.141      0.141
          FEMALE     I    0.141     -0.141
                     I
EMPREL    MALE       I    0.110     -0.110
          FEMALE     I   -0.110      0.110
                     I
EMPNOREL  MALE       I    0.029     -0.029
          FEMALE     I   -0.029      0.029
                     I
UNEMP     MALE       I    0.001     -0.001
          FEMALE     I   -0.001      0.001
-------------------------------------------
```

Table B.2

```
        ESTIMATES OF THE LOG-LINEAR PARAMETERS (LAMBDA)
LMSTAT4   MINORITYI   SES       (F)
   L          R   I    LO          HIGH
-------------------------------------------
OLF       WHITE   I    -0.125      0.125
          MINORITYI     0.125     -0.125
                  I
EMPREL    WHITE   I    -0.072      0.072
          MINORITYI     0.072     -0.072
                  I
EMPNOREL  WHITE   I    -0.002      0.002
          MINORITYI     0.002     -0.002
                  I
UNEMP     WHITE   I     0.200     -0.200
          MINORITYI    -0.200      0.200
-------------------------------------------
```

Table B.2

The fitted model is not direct; therefore,
the variance of lambda is computed using
the direct model - FPL, FSL, FRL.

Estimates of the Log-Linear Parameters Divided by their
Standard Errors

```
SES        (F)
   LO          HIGH
-----------------------
   5.091     -5.091
-----------------------


SEX        (S)
   MALE        FEMALE
-----------------------
  -7.763      7.763
-----------------------


MINORITY(R)
   WHITE       MINORITY
-----------------------
  23.518     -23.518
-----------------------


PROFILE (P)
   C           LC          CEIP
----------------------------------
 -10.668     -1.076      16.361
----------------------------------


LMSTAT4 (L)
   OLF         EMPREL      EMPNOREL UNEMP
---------------------------------------------
  -2.810      10.752      4.043    -7.820
---------------------------------------------


SEX       I  SES       (F)
     S    I  LO           HIGH
----------------------------------
MALE      I  -2.475       2.475
FEMALE    I   2.475      -2.475
----------------------------------


MINORITYI  SES       (F)
   R    I  LO           HIGH
----------------------------------
WHITE   I  -7.176       7.176
MINORITYI   7.176      -7.176
----------------------------------
```

Table B.2

Estimates of the Log-Linear Parameters Divided by their Standard Errors

```
PROFILE  I   SES       (F)
    P    I    LO          HIGH
------------------------------
C        I    3.117     -3.117
LC       I    0.441     -0.441
CEIP     I   -4.924      4.924
------------------------------
```

```
LMSTAT4   I   SES       (F)
    L     I    LO          HIGH
-------------------------------
OLF       I   -2.530      2.530
EMPREL    I    1.197     -1.197
EMPNORELI     -0.213      0.213
UNEMP     I    1.444     -1.444
-------------------------------
```

```
LMSTAT4   I   SEX       (S)
    L     I    MALE      FEMALE
-------------------------------
OLF       I   -4.812      4.812
EMPREL    I    0.114     -0.114
EMPNORELI      4.600     -4.600
UNEMP     I    0.888     -0.888
-------------------------------
```

```
LMSTAT4   I   MINORITY(R)
    L     I    WHITE     MINORITY
---------------------------------
OLF       I    0.095     -0.095
EMPREL    I    2.192     -2.192
EMPNORELI      3.517     -3.517
UNEMP     I   -4.503      4.503
---------------------------------
```

```
LMSTAT4   I   PROFILE (P)
    L     I    C             LC          CEIP
---------------------------------------------
OLF       I   -0.694     -0.941       2.048
EMPREL    I    3.634      0.996      -5.908
EMPNORELI     -2.765      0.716       3.149
UNEMP     I    0.253     -0.324      -0.005
---------------------------------------------
```

Table B.2

Estimates of the Log-Linear Parameters Divided by their Standard Errors

```
LMSTAT4   SEX       I   SES       (F)
   L          S     I    LO         HIGH
------------------------------------------
OLF       MALE      I    -2.809     2.809
          FEMALE    I     2.809    -2.809
                    I
EMPREL    MALE      I     2.901    -2.900
          FEMALE    I    -2.900     2.901
                    I
EMPNOREL  MALE      I     0.739    -0.739
          FEMALE    I    -0.739     0.739
                    I
UNEMP     MALE      I     0.023    -0.023
          FEMALE    I    -0.023     0.023
------------------------------------------
```

```
LMSTAT4   MINORITYI   SES       (F)
   L          R   I    LO         HIGH
------------------------------------------
OLF       WHITE   I    -1.956     1.956
          MINORITYI     1.956    -1.956
                  I
EMPREL    WHITE   I    -1.306     1.307
          MINORITYI     1.307    -1.306
                  I
EMPNOREL  WHITE   I    -0.037     0.037
          MINORITYI     0.037    -0.037
                  I
UNEMP     WHITE   I     2.688    -2.688
          MINORITYI    -2.688     2.688
------------------------------------------
```

Table B.2

```
THETA (MEAN) -------     10.439

         ESTIMATES OF THE MULTIPLICATIVE PARAMETERS (BETA)
SES       (F)
    LO         HIGH
--------------------------
    1.240      0.806
--------------------------

         ESTIMATES OF THE MULTIPLICATIVE PARAMETERS (BETA)
SEX       (S)
    MALE       FEMALE
--------------------------
    0.804      1.244
--------------------------

         ESTIMATES OF THE MULTIPLICATIVE PARAMETERS (BETA)
MINORITY(R)
    WHITE      MINORITY
--------------------------
    2.370      0.422
--------------------------

         ESTIMATES OF THE MULTIPLICATIVE PARAMETERS (BETA)
PROFILE (P)
    C          LC         CEIP
--------------------------------------
    0.553      0.953      1.897
--------------------------------------

         ESTIMATES OF THE MULTIPLICATIVE PARAMETERS (BETA)
LMSTAT4  (L)
    OLF        EMPREL     EMPNOREL UNEMP
--------------------------------------------------
    0.812      1.903      1.306    0.495
--------------------------------------------------

         ESTIMATES OF THE MULTIPLICATIVE PARAMETERS (BETA)
SEX        I  SES         (F)
     S     I   LO          HIGH
------------------------------------
MALE       I   0.933       1.072
FEMALE     I   1.072       0.933
------------------------------------

         ESTIMATES OF THE MULTIPLICATIVE PARAMETERS (BETA)
MINORITYI  SES         (F)
     R     I   LO          HIGH
------------------------------------
WHITE      I   0.769       1.301
MINORITYI      1.301       0.769
------------------------------------
```

Table B.2

```
          ESTIMATES OF THE MULTIPLICATIVE PARAMETERS (BETA)
PROFILE I  SES      (F)
     P  I   LO          HIGH
--------------------------------
C       I   1.189       0.841
LC      I   1.020       0.981
CEIP    I   0.825       1.213
--------------------------------
```

```
          ESTIMATES OF THE MULTIPLICATIVE PARAMETERS (BETA)
LMSTAT4 I  SES      (F)
     L  I   LO          HIGH
--------------------------------
OLF       I   0.829       1.206
EMPREL    I   1.074       0.931
EMPNORELI   0.986       1.014
UNEMP     I   1.136       0.878
--------------------------------
```

```
          ESTIMATES OF THE MULTIPLICATIVE PARAMETERS (BETA)
LMSTAT4 I  SEX      (S)
     L  I   MALE        FEMALE
--------------------------------
OLF       I   0.786       1.273
EMPREL    I   1.004       0.996
EMPNORELI   1.198       0.835
UNEMP     I   1.058       0.945
--------------------------------
```

```
          ESTIMATES OF THE MULTIPLICATIVE PARAMETERS (BETA)
LMSTAT4 I  MINORITY(R)
     L  I   WHITE       MINORITY
--------------------------------
OLF       I   1.006       0.994
EMPREL    I   1.129       0.886
EMPNORELI   1.230       0.813
UNEMP     I   0.716       1.397
--------------------------------
```

```
          ESTIMATES OF THE MULTIPLICATIVE PARAMETERS (BETA)
LMSTAT4 I  PROFILE (P)
     L  I   C           LC          CEIP
--------------------------------------------
OLF       I   0.941       0.933       1.139
EMPREL    I   1.282       1.059       0.736
EMPNORELI   0.801       1.047       1.193
UNEMP     I   1.035       0.967       1.000
--------------------------------------------
```

Table B.2

```
           ESTIMATES OF THE MULTIPLICATIVE PARAMETERS (BETA)
LMSTAT4    SEX       I   SES       (F)
   L          S      I   LO           HIGH
-------------------------------------------
OLF        MALE      I   0.869        1.151
           FEMALE    I   1.151        0.869
                     I
EMPREL     MALE      I   1.117        0.896
           FEMALE    I   0.896        1.117
                     I
EMPNOREL   MALE      I   1.029        0.971
           FEMALE    I   0.971        1.029
                     I
UNEMP      MALE      I   1.001        0.999
           FEMALE    I   0.999        1.001
-------------------------------------------

           ESTIMATES OF THE MULTIPLICATIVE PARAMETERS (BETA)
LMSTAT4    MINORITYI   SES       (F)
   L             R I   LO           HIGH
-------------------------------------------
OLF        WHITE     I   0.882        1.134
           MINORITYI     1.134        0.882
                     I
EMPREL     WHITE     I   0.930        1.075
           MINORITYI     1.075        0.930
                     I
EMPNOREL   WHITE     I   0.998        1.002
           MINORITYI     1.002        0.998
                     I
UNEMP      WHITE     I   1.221        0.819
           MINORITYI     0.819        1.221
-------------------------------------------
```

TABLE B.3: COMPLETE TABLE 4.10
LOG-LINEAR MODEL: RL, RC, PL, SPC, SCI

Model fit:		
	Degrees of Freedom:	62
	Likelihood Ratio Chi Square	51.98
	Probability	.814
	Pearson Chi square	53.45
	Probability	.772

Variable Name	(Symbol)	Variable Categories	(Symbol)
Specialty Area			
SPECIAL	(C)	Office Occupations	(OFFICE)
		Trade and Industry	(TANDI)
Labor Force Status			
LMSTAT3	(L)	Out of the Labor Force	(OLF)
		Employed	(EMP)
		Unemployed	(UNEMP)
Patterns of Vocational Participation			
PROFILE	(P)	Concentrator	(C)
		Limited Concentrator	(LC)
		Concentrator/Explorer	(CE)
		Incidental/Personal	(ELSE)
Race Status			
MINORITY	(R)	White	(WHITE)
		Black and Hispanic	(MINORITY)
Sex			
SEX	(S)	Male	(MALE)
		Female	(FEMALE)

Table B.3

```
      THE FITTED VALUES

   SPECIAL   LMSTAT3   PROFILE   MINORITYI  SEX        (S)
      C         L         P          R   I    MALE       FEMALE
   ---------------------------------------------------------------
   OFFICE    OLF       C         WHITE   I     1.378     33.996
                                 MINORITYI     0.258      6.373
                                         I
                       LC        WHITE   I    12.411     47.643
                                 MINORITYI     2.326      8.931
                                         I
                       CE        WHITE   I     7.131     32.094
                                 MINORITYI     1.337      6.016
                                         I
                       ELSE      WHITE   I    55.714     90.905
                                 MINORITYI    10.444     17.041
                      -------------------I-------------------------
             EMP       C         WHITE   I     5.937    125.617
                                 MINORITYI     0.745     15.762
                                         I
                       LC        WHITE   I    51.265    168.850
                                 MINORITYI     6.433     21.187
                                         I
                       CE        WHITE   I    29.147    112.543
                                 MINORITYI     3.657     14.122
                                         I
                       ELSE      WHITE   I   162.435    227.387
                                 MINORITYI    20.382     28.532
                      -------------------I-------------------------
             UNEMP     C         WHITE   I     0.527     11.786
                                 MINORITYI     0.155      3.466
                                         I
                       LC        WHITE   I     4.300     14.983
                                 MINORITYI     1.265      4.406
                                         I
                       CE        WHITE   I     2.880     11.765
                                 MINORITYI     0.847      3.460
                                         I
                       ELSE      WHITE   I    16.248     24.060
                                 MINORITYI     4.778      7.076
                      -------------------I-------------------------
```

Table B.3

The Fitted Values

TANDI	OLF	C	WHITE	4.725	1.527
			MINORITY	1.315	0.425
		LC	WHITE	5.726	6.547
			MINORITY	1.593	1.822
		CE	WHITE	2.285	1.956
			MINORITY	0.636	0.544
		ELSE	WHITE	4.475	2.488
			MINORITY	1.245	0.692
	EMP	C	WHITE	61.504	4.198
			MINORITY	11.456	0.782
		LC	WHITE	71.476	17.261
			MINORITY	13.313	3.215
		CE	WHITE	28.221	5.102
			MINORITY	5.257	0.950
		ELSE	WHITE	39.429	4.629
			MINORITY	7.344	0.862
	UNEMP	C	WHITE	6.265	0.744
			MINORITY	2.735	0.325
		LC	WHITE	6.886	2.893
			MINORITY	3.006	1.263
		CE	WHITE	3.203	1.007
			MINORITY	1.398	0.440
		ELSE	WHITE	4.530	0.925
			MINORITY	1.977	0.404

Table B.3

```
THETA (MEAN) -------     1.634

        ESTIMATES OF THE LOG-LINEAR PARAMETERS (LAMBDA)
SEX         (S)
    MALE       FEMALE
--------------------------
   -0.067      0.067
--------------------------

        ESTIMATES OF THE LOG-LINEAR PARAMETERS (LAMBDA)
MINORITY(R)
    WHITE     MINORITY
--------------------------
    0.730     -0.730
--------------------------

        ESTIMATES OF THE LOG-LINEAR PARAMETERS (LAMBDA)
PROFILE  (P)
    C           LC          CE          ELSE
--------------------------------------------------
   -0.584      0.415      -0.306       0.475
--------------------------------------------------

        ESTIMATES OF THE LOG-LINEAR PARAMETERS (LAMBDA)
LMSTAT3  (L)
    OLF         EMP         UNEMP
--------------------------------------
   -0.266      0.999      -0.733
--------------------------------------

        ESTIMATES OF THE LOG-LINEAR PARAMETERS (LAMBDA)
SPECIAL  (C)
    OFFICE     TANDI
--------------------------
    0.620     -0.620
--------------------------

        ESTIMATES OF THE LOG-LINEAR PARAMETERS (LAMBDA)
PROFILE  I   SEX       (S)
    P    I     MALE        FEMALE
--------------------------------------
C        I    -0.219      0.219
LC       I    -0.069      0.069
CE       I    -0.037      0.037
ELSE     I     0.325     -0.325
--------------------------------------

        ESTIMATES OF THE LOG-LINEAR PARAMETERS (LAMBDA)
LMSTAT3  I   SEX       (S)
    L    I     MALE        FEMALE
--------------------------------------
OLF      I    -0.234      0.234
EMP      I     0.193     -0.193
UNEMP    I     0.041     -0.041
--------------------------------------
```

Table B.3

```
            ESTIMATES OF THE LOG-LINEAR PARAMETERS (LAMBDA)
  SPECIAL I  SEX       (S)
     C    I   MALE       FEMALE
  ------------------------------
  OFFICE  I  -0.710      0.710
  TANDI   I   0.710     -0.710
  ------------------------------

            ESTIMATES OF THE LOG-LINEAR PARAMETERS (LAMBDA)
  LMSTAT3 I  MINORITY(R)
     L    I   WHITE      MINORITY
  ------------------------------
  OLF     I   0.008     -0.008
  EMP     I   0.209     -0.209
  UNEMP   I  -0.217      0.217
  ------------------------------

            ESTIMATES OF THE LOG-LINEAR PARAMETERS (LAMBDA)
  SPECIAL I  MINORITY(R)
     C    I   WHITE      MINORITY
  ------------------------------
  OFFICE  I   0.099     -0.099
  TANDI   I  -0.099      0.099
  ------------------------------

            ESTIMATES OF THE LOG-LINEAR PARAMETERS (LAMBDA)
  LMSTAT3 I  PROFILE (P)
     L    I   C          LC         CE         ELSE
  ---------------------------------------------------
  OLF     I  -0.066     -0.020     -0.067      0.154
  EMP     I   0.055      0.059      0.001     -0.115
  UNEMP   I   0.012     -0.040      0.066     -0.038
  ---------------------------------------------------

            ESTIMATES OF THE LOG-LINEAR PARAMETERS (LAMBDA)
  SPECIAL I  PROFILE (P)
     C    I   C          LC         CE         ELSE
  ---------------------------------------------------
  OFFICE  I  -0.450     -0.228      0.066      0.612
  TANDI   I   0.450      0.228     -0.066     -0.612
  ---------------------------------------------------

            ESTIMATES OF THE LOG-LINEAR PARAMETERS (LAMBDA)
  SPECIAL I  LMSTAT3 (L)
     C    I   OLF        EMP        UNEMP
  ----------------------------------------
  OFFICE  I   0.200     -0.003     -0.197
  TANDI   I  -0.200      0.003      0.197
  ----------------------------------------
```

Table B.3

```
      ESTIMATES OF THE LOG-LINEAR PARAMETERS (LAMBDA)
SPECIAL   PROFILE I   SEX       (S)
   C          P   I    MALE        FEMALE
--------------------------------------------
OFFICE    C       I   -0.566       0.566
          LC      I    0.215      -0.215
          CE      I    0.103      -0.103
          ELSE    I    0.248      -0.248
                  I
TANDI     C       I    0.566      -0.566
          LC      I   -0.215       0.215
          CE      I   -0.103       0.103
          ELSE    I   -0.248       0.248
--------------------------------------------

      ESTIMATES OF THE LOG-LINEAR PARAMETERS (LAMBDA)
SPECIAL   LMSTAT3 I   SEX       (S)
   C          L   I    MALE        FEMALE
--------------------------------------------
OFFICE    OLF     I    0.192      -0.192
          EMP     I   -0.158       0.158
          UNEMP   I   -0.034       0.034
                  I
TANDI     OLF     I   -0.192       0.192
          EMP     I    0.158      -0.158
          UNEMP   I    0.034      -0.034
--------------------------------------------
```

Table B.3

The fitted model is not direct, therefore; the variance of lambda is computed using the direct model - SPLC, RLC.

Estimates of Log-Linear Parameters Divided by their Standard Errors

```
SEX        (S)
   MALE        FEMALE
-------------------------
  -1.049       1.049
-------------------------


MINORITY(R)
   WHITE       MINORITY
-------------------------
  14.545     -14.545
-------------------------


PROFILE  (P)
   C           LC          CE          ELSE
---------------------------------------------
  -4.759      4.426      -2.684       4.466
---------------------------------------------


LMSTAT3  (L)
   OLF         EMP         UNEMP
-----------------------------------
  -2.781     12.609      -6.613
-----------------------------------


SPECIAL  (C)
   OFFICE      TANDI
-------------------------
   9.121      -9.121
-------------------------


PROFILE  I   SEX        (S)
      P  I     MALE         FEMALE
------------------------------------
C        I    -1.781        1.781
LC       I    -0.740        0.740
CE       I    -0.323        0.323
ELSE     I     3.053       -3.053
------------------------------------


LMSTAT3  I   SEX        (S)
      L  I     MALE         FEMALE
------------------------------------
OLF      I    -2.626        2.626
EMP      I     2.667       -2.667
UNEMP    I     0.390       -0.390
------------------------------------
```

Table B.3

Estimates of the Log-Linear Parameters Divided by their Standard Errors

```
SPECIAL  I   SEX        (S)
   C     I    MALE         FEMALE
----------------------------------
OFFICE   I  -11.201     11.201
TANDI    I   11.201    -11.201
----------------------------------
```

```
LMSTAT3  I   MINORITY(R)
   L     I    WHITE      MINORITY
----------------------------------
OLF      I     0.109     -0.109
EMP      I     3.616     -3.616
UNEMP    I    -2.750      2.749
----------------------------------
```

```
SPECIAL  I   MINORITY(R)
   C     I    WHITE      MINORITY
----------------------------------
OFFICE   I     1.967     -1.967
TANDI    I    -1.967      1.967
----------------------------------
```

```
LMSTAT3  I   PROFILE (P)
   L     I   C            LC          CE          ELSE
-------------------------------------------------------
OLF      I    -0.388     -0.154     -0.415      1.018
EMP      I     0.376      0.568      0.010     -0.963
UNEMP    I     0.058     -0.249      0.353     -0.218
-------------------------------------------------------
```

```
SPECIAL  I   PROFILE (P)
   C     I   C            LC          CE          ELSE
-------------------------------------------------------
OFFICE   I    -3.668     -2.433      0.580      5.755
TANDI    I     3.668      2.433     -0.580     -5.755
-------------------------------------------------------
```

```
SPECIAL  I   LMSTAT3 (L)
   C     I    OLF         EMP         UNEMP
--------------------------------------------
OFFICE   I     2.089     -0.038     -1.773
TANDI    I    -2.090      0.038      1.773
--------------------------------------------
```

Table B.3

Estimates of the Log-Linear Parameters Divided by their Standard Errors

```
SPECIAL   PROFILE  I   SEX        (S)
   C         P     I    MALE       FEMALE
-----------------------------------------
OFFICE    C        I   -4.612      4.612
          LC       I    2.290     -2.290
          CE       I    0.901     -0.901
          ELSE     I    2.336     -2.336
                   I
TANDI     C        I    4.612     -4.612
          LC       I   -2.290      2.290
          CE       I   -0.901      0.901
          ELSE     I   -2.336      2.336
-----------------------------------------
```

```
SPECIAL   LMSTAT3  I   SEX        (S)
   C         L     I    MALE       FEMALE
-----------------------------------------
OFFICE    OLF      I    2.158     -2.158
          EMP      I   -2.185      2.185
          UNEMP    I   -0.324      0.325
                   I
TANDI     OLF      I   -2.158      2.158
          EMP      I    2.185     -2.185
          UNEMP    I    0.324     -0.324
-----------------------------------------
```

Table B.3

```
THETA (MEAN) -------     5.122

       ESTIMATES OF THE MULTIPLICATIVE PARAMETERS (BETA)
SEX       (S)
    MALE      FEMALE
------------------------
    0.936     1.069
------------------------

       ESTIMATES OF THE MULTIPLICATIVE PARAMETERS (BETA)
MINORITY(R)
    WHITE     MINORITY
------------------------
    2.075     0.482
------------------------

       ESTIMATES OF THE MULTIPLICATIVE PARAMETERS (BETA)
PROFILE (P)
    C         LC        CE        ELSE
----------------------------------------
    0.558     1.515     0.736     1.606
----------------------------------------

       ESTIMATES OF THE MULTIPLICATIVE PARAMETERS (BETA)
LMSTAT3 (L)
    OLF       EMP       UNEMP
------------------------------
    0.767     2.715     0.480
------------------------------

       ESTIMATES OF THE MULTIPLICATIVE PARAMETERS (BETA)
SPECIAL (C)
    OFFICE    TANDI
------------------------
    1.858     0.538
------------------------

       ESTIMATES OF THE MULTIPLICATIVE PARAMETERS (BETA)
PROFILE I   SEX       (S)
      P   I     MALE      FEMALE
--------------------------------
C         I     0.804     1.244
LC        I     0.933     1.072
CE        I     0.964     1.037
ELSE      I     1.384     0.723
--------------------------------

       ESTIMATES OF THE MULTIPLICATIVE PARAMETERS (BETA)
LMSTAT3 I   SEX       (S)
      L   I     MALE      FEMALE
--------------------------------
OLF       I     0.791     1.263
EMP       I     1.213     0.824
UNEMP     I     1.042     0.960
--------------------------------
```

Table B.3

```
               ESTIMATES OF THE MULTIPLICATIVE PARAMETERS (BETA)
LMSTAT3  I   PROFILE (P)
   L     I     C             LC          CE          ELSE
----------------------------------------------------------
OLF      I     0.936         0.980       0.935       1.166
EMP      I     1.056         1.061       1.001       0.891
UNEMP    I     1.012         0.961       1.068       0.962
----------------------------------------------------------

               ESTIMATES OF THE MULTIPLICATIVE PARAMETERS (BETA)
SPECIAL  I   PROFILE (P)
   C     I     C             LC          CE          ELSE
----------------------------------------------------------
OFFICE   I     0.638         0.796       1.068       1.844
TANDI    I     1.568         1.256       0.936       0.542
----------------------------------------------------------

               ESTIMATES OF THE MULTIPLICATIVE PARAMETERS (BETA)
SPECIAL  I   LMSTAT3 (L)
   C     I     OLF           EMP         UNEMP
----------------------------------------------
OFFICE   I     1.221         0.997       0.822
TANDI    I     0.819         1.003       1.217
----------------------------------------------

               ESTIMATES OF THE MULTIPLICATIVE PARAMETERS (BETA)
SPECIAL  I   SEX      (S)
   C     I     MALE          FEMALE
-----------------------------------
OFFICE   I     0.492         2.034
TANDI    I     2.034         0.492
-----------------------------------

               ESTIMATES OF THE MULTIPLICATIVE PARAMETERS (BETA)
LMSTAT3  I   MINORITY(R)
   L     I     WHITE         MINORITY
-----------------------------------
OLF      I     1.008         0.992
EMP      I     1.232         0.812
UNEMP    I     0.805         1.242
-----------------------------------

               ESTIMATES OF THE MULTIPLICATIVE PARAMETERS (BETA)
SPECIAL  I   MINORITY(R)
   C     I     WHITE         MINORITY
-----------------------------------
OFFICE   I     1.104         0.906
TANDI    I     0.906         1.104
-----------------------------------
```

Table B.3

```
          ESTIMATES OF THE MULTIPLICATIVE PARAMETERS (BETA)
SPECIAL   PROFILE I   SEX       (S)
   C            P I    MALE       FEMALE
---------------------------------------------
OFFICE    C       I    0.568      1.761
          LC      I    1.240      0.807
          CE      I    1.108      0.902
          ELSE    I    1.282      0.780
                  I
TANDI     C       I    1.761      0.568
          LC      I    0.807      1.240
          CE      I    0.902      1.108
          ELSE    I    0.780      1.282
---------------------------------------------
```

```
          ESTIMATES OF THE MULTIPLICATIVE PARAMETERS (BETA)
SPECIAL   LMSTAT3 I   SEX       (S)
   C            L I    MALE       FEMALE
---------------------------------------------
OFFICE    OLF     I    1.212      0.825
          EMP     I    0.854      1.171
          UNEMP   I    0.967      1.034
                  I
TANDI     OLF     I    0.825      1.212
          EMP     I    1.171      0.854
          UNEMP   I    1.034      0.967
---------------------------------------------
```

APPENDIX C

REPRESENTATIVE RESULTS OF REGRESSIONS ON EARNINGS

APPENDIX C
REPRESENTATIVE RESULTS OF REGRESSIONS ON EARNINGS

TABLE C.1: TOTAL EFFECTS ON USUAL WEEKLY EARNINGS
(DOLLARS PER WEEK)
ALL RESPONDENTS NOT ENROLLED
(EQUATION 1c) OLS

Education Variable	White Male	Minority Male	White Female	Minority Female
CONC	-3.81	-15.63	10.29	39.98**
	(.2)	(.6)	(.9)	(2.0)
LCON	3.32	-12.50	-1.01	14.38
	(.2)	(.5)	(.1)	(.9)
CONEX	9.71	10.37	1.43	6.64
	(.4)	(.4)	(.1)	(.4)
EXP+	26.62	-69.30	.27	47.81
	(.6)	(1.2)	(.0)	(1.4)
IP	3.21	-4.05	.76	9.16
	(.2)	(.2)	(.1)	(.6)
N	373	151	459	183
R^2	.03	.16	.05	.13
Adj. R^2	.00	.09	.03	.06
F	1.07	2.25	1.98	1.89

t Values in parentheses
* Significant at .10 level
** Significant at .05 level
+ Estimates for explorers are based on only 2 to 6 observations and should be interpreted cautiously
The equations controlled for region of residence, rural/urban residence, SES, class rank, and work experience.

APPENDIX C
(Continued)

TABLE C.2: TOTAL EFFECTS ON USUAL HOURLY EARNINGS (DOLLARS PER HOUR) NOT ENROLLED, EXACTLY TWELVE YEARS OF EDUCATION (EQUATION 1c) OLS

Education Variable	White Male	Minority Male	White Female	Minority Female
CONC	-.61 (1.3)	-.84 (.9)	.00 (.0)	1.25** (2.8)
LCON	-.27 (.6)	-.46 (.6)	-.21 (.7)	.12 (.4)
CONEX	-.05 (.1)	.35 (.4)	.12 (.4)	.23 (.6)
EXP^{+}	.53 (.5)	-.10 (.1)	-.18 (.2)	2.03 (2.6)
IP	-.30 (.8)	.21 (.3)	-.12 (.4)	.49 (1.3)
N	302	117	336	131
R^2	.08	.11	.13	.20
Adj. R^2	.05	.01	.09	.12
F	2.19	1.09	3.06	2.30

t Values in parentheses
* Significant at .10 level
** Significant at .05 level
+ Estimates for explorers are based on only 2 to 6 observations and should be interpreted cautiously

The equations controlled for region of residence, rural/urban residence, SES, class rank, and work experience.

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